JUL 9 1928

Founded 1874—Fifty-Four Years of Service

Electrical World

McGraw-Hill Publishing Company, Inc. JULY 7, 1928 Twenty-five Cents Per Copy

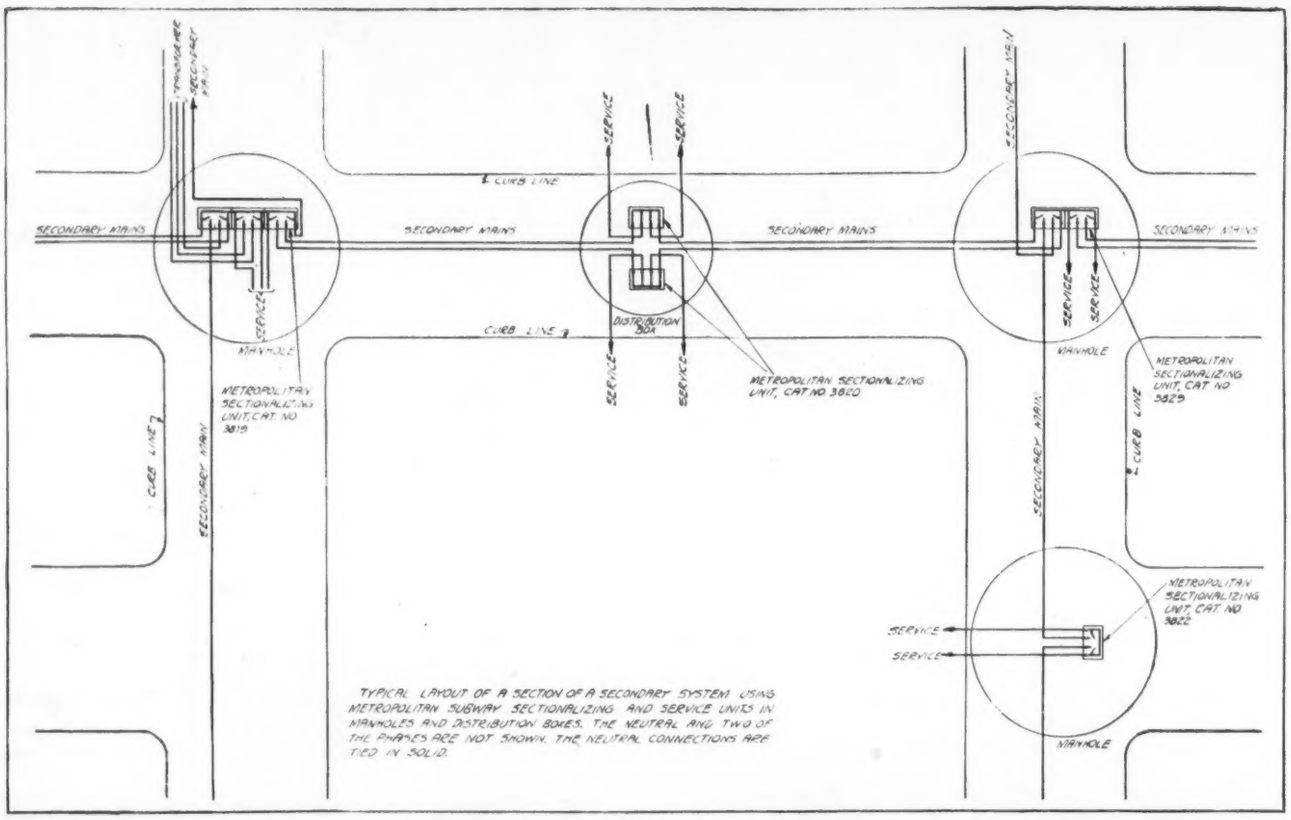
5 Turbines ran 4 years on original charge of oil—only make-up oil required

Do Service Station records like this interest you? Let us tell you the story.
GARGOYLE
Lubricating Oils
The World's Quality Oils for Plant Lubrication

VACUUM OIL COMPANY

Headquarters: 61 BROADWAY, NEW YORK. *Branches and distributing warehouses throughout the country*

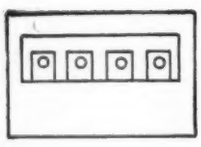
Your Network Sectionalized

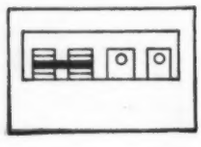


for maximum flexibility

Metropolitan Subway Sectionalizing Units

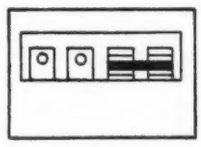
When emergencies arise these units enable the cutting out of any section without loss of revenue from other sections immediately adjacent. They protect your employees, the public and your good will.

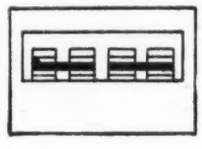




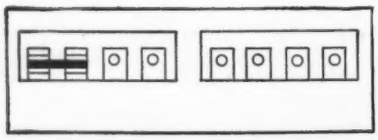
These new Metropolitan subway sectionalizing units are available in two distinct types—one with a maximum of 500 amperes current carrying capacity and the other with a maximum current carrying capacity of 1500 amperes, both at 250 volts.

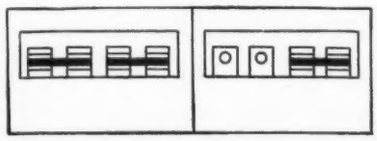
Herewith are shown some of the unit combinations possible and a few groupings. If you are planning some underground distribution, we shall gladly send you a sample unit or make up a unit for your particular needs.





METROPOLITAN
DEVICE CORPORATION
1250 ATLANTIC AVENUE
BROOKLYN · NEW YORK
SINCE 1899





Vol. 92, No. 1 New York, July 7, 1928 *Pages 1 to 50*

L. W. W. MORROW, Managing Editor
EARL WHITEHORNE, Commercial Editor
ALLEN M. PERRY, Associate Editor
G. F. WITTIG, Statistical Editor
H. M. CAMERON, Financial Editor
F. C. WELLS, News Editor
EUSTACE C. SOARES, Manufacturing and Markets Editor

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

W. H. ONKEN, JR., *Editor*

FRANK R. INNES and T. P. KINDIG, Western Editors, 7 South Dearborn St., Chicago
H. S. KNOWLTON, New England Editor, 88 Tremont St., Boston
WALTER C. HESTON, Pacific Coast Editor, 883 Mission St., San Francisco
E. R. SEARLES, Assistant Editor
PAUL WOOTON, Washington Correspondent, National Press Bldg., Washington

Contents of This Issue

Report of the A.I.E.E. Summer Meeting

Lightning surges and high-speed air breakers received the most consideration at the Denver meeting. A diversified program attracted a large attendance 9

EDITORIALS 1

Frontispiece—R. F. SCHUCHARDT... 4

SURGE VOLTAGE INVESTIGATIONS... 5
Observations on six different systems reported at A.I.E.E. convention. Effect of ground wires, choke coils and lightning arresters. Polarity, magnitude, wave front and attenuation.

COST OF A SWITCHING STATION.... 8

TIME SWITCHES CONTROL STREET LIGHTING 17
By O. W. Holden

FACILITIES FOR RAILROAD SERVICE.. 18
By R. B. Morton
Requirements governing arrangement of equipment and features of latest Pennsylvania electrification.

FINANCING THROUGH RIGHTS..... 19

RADIO INTERFERENCE COMPLAINTS AND INVESTIGATION COSTS..... 20
By J. B. Prince

OPERATING DESK THAT FACILITATES LOAD DISPATCHING 21
By B. N. Merritt

ROCK ANCHOR 21

RELAMPING PRESENT SOCKETS INCREASES REVENUE 22
By M. Luckiesh

If You Bind Your "Electrical World" Ask for an Index

THE regular index to the January-June, 1928, issues of ELECTRICAL WORLD has been published as a separate pamphlet this year, with elaborate cross-references. If you bind your copies of ELECTRICAL WORLD please write direct to the Circulation Department, McGraw-Hill Publishing Company, Tenth Avenue at 36th Street, New York City, and ask for one. It will be sent to you at once. When you write, please state your name, position, company and address.

ROASTING CEREALS WITH ELECTRIC HEAT 22
By George W. Bernhard

WHERE THE JOBBER STANDS..... 23
By George E. Cullinan

STREET LIGHTING EXPENDITURES BY 42 CITIES COMPARED 25
By Otto P. Ortlieb

DEMONSTRATES ACCURACY OF METERS TO PUBLIC 25

FIXED MOVING DAYS AND EFFECT ON UTILITIES 26

LETTERS FROM OUR READERS..... 26

DIGEST OF ELECTRICAL LITERATURE. 27

BOOK REVIEWS 28

NEWS OF THE INDUSTRY..... 29

COURT DECISIONS AND COMMISSION RULINGS 36

MEN OF THE INDUSTRY..... 37

FINANCIAL AND STATISTICAL..... 39

BUSINESS NEWS AND MARKET CONDITIONS 43

NEW EQUIPMENT AVAILABLE..... 46

ELECTRICAL PATENTS 47

DIRECTORY OF ELECTRICAL ASSOCIATIONS 48

BUSINESS FACTS FOR ELECTRICAL MEN 49

McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., NEW YORK, N. Y.

JAMES H. McGRAW, President
JAMES H. McGRAW, Jr., Vice-Pres. and Treas.
MALCOLM MUIR, Vice-President
EDWARD J. MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
C. H. THOMPSON, Secretary

NEW YORK District Office, 285 Madison Ave.
WASHINGTON, National Press Building
CHICAGO, 7 South Dearborn St.
PHILADELPHIA, 1600 Arch St.
CLEVELAND, Guardian Building
ST. LOUIS, Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie Street, London E. C. 4

Cable Address "Machinist, N. Y."

Publishers of
Engineering News-Record — American Machinist
Power — Chemical and Metallurgical Engineering
Coal Age — Engineering and Mining Journal
Electrical Merchandising
Ingeniería Internacional — Electric Railway Journal
Bus Transportation — Construction Methods
Electrical World — Radio Retailing
Electrical West
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

Member Audit Bureau of Circulations
Member Associated Business Papers, Inc.
Circulation of this issue, 18,850

The annual subscription rate is $5 in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, Haiti and Paraguay. Extra postage to other countries $4 (total $9 or 38 shillings). Subscriptions may be sent to the New York office or to the London office. Single copies, postage prepaid to any part of the world, 25 cents.
Change of Address—When change of address is ordered the *new* and the *old* address must be given. Notice must be received at least ten days before the change takes place.

Copyright, 1928, by McGraw-Hill Publishing Company, Inc.

Published weekly

Entered as second-class matter Jan. 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879.
Printed in U. S. A.

Advertising Index—Alphabetical, 130; Classified, 124, 126, 128; Directory of Engineers, 62, 63; Searchlight Section, 64-69

OKONITE
Quality Which Can't Be "Hurried"
What Quantity in the Finished Product
Elasticity and Toughness due to Thorough Mixing
The Rubber Which Assures Long-Lasting Insulation
Our Exclusive Method of Applying Insulation
Vulcanization that Preserves Insulation
Every Single Foot is Doubly Tested

In this Series of Advertisements

—we have summarized the manufacturing methods which make Okonite Rubber Insulated Wires and Cables not only high in quality but of a *different* quality than any other insulated wire and cable made.

It would be impossible to duplicate this distinctive Okonite quality without duplicating:

The quality of our crude rubber.

Our methods of cleaning and drying.

The kind and proportion of ingredients we mix into the compound.

Our method of mixing on a Jumbo Grinder.

Our method of calendering and of backing the calendered sheets with tin.

Our method of folding these tin-backed strips around the conductor.

Our method of vulcanizing in rigid tin moulds.

Our method of doubly testing every single foot of finished product.

As a number of these methods are entirely exclusive it is evident that Okonite Quality *cannot* be duplicated. This fact explains the *unparalleled* performance, economy and satisfaction rendered by all products which bear the Okonite name.

The Okonite Company

The Okonite-Callender Cable Company, Inc.

Factories: PASSAIC, N. J. PATERSON, N. J.

Sales Offices: NEW YORK CHICAGO PITTSBURGH
ST. LOUIS ATLANTA BIRMINGHAM
SAN FRANCISCO LOS ANGELES SEATTLE

General Electric Supply Corporation, Boston, Mass.
Novelty Electric Co., Philadelphia, Pa.
F. D. Lawrence Electric Co., Cincinnati, O.

Canadian Representatives:
Engineering Materials Limited
Montreal

Cuban Representatives:
Victor G. Mendoza Co.
Havana

Electrical World

McGraw-Hill Publishing Company, Inc.
JAMES H. MCGRAW, *President*
EDGAR KOBAK, *Vice-President*

W. H. ONKEN, JR.
Editor

VOLUME 92 — *New York, Saturday, July 7, 1928* — NUMBER 1

The American Engineers' Contribution to Louvain

JULY FOURTH long ago ceased to be confined by the boundaries of the United States. For many years echoes of celebrations held in Europe by transplanted Americans and their transatlantic friends have floated across the ocean as regularly as the day has come around. On Wednesday of this week an event of interest to all Americans and of especial interest to American engineers took place at Louvain, Belgium. Before a distinguished gathering of educators, scientists, ecclesiasts and engineers the new university library, built with contributions from more than half a million Americans, including in their number school children, college students, policemen and firemen, was dedicated. The event is a memorable instance of international comity and a splendid tribute to the Belgian people. But what made it of unique interest to our engineers was the inclusion in the dedication ceremony of the presentation and acceptance of the clock and carillon given by the national engineering societies of the United States as a memorial to the American engineers who lost their lives in the World War.

The tower with its clock of forty-eight stars and carillon of forty-eight bells is the crowning ornament of the library building and the only memorial in Europe to American engineers. The Engineering Foundation became sponsor for the plan on the suggestion of Edward Dean Adams. It received contributions from thousands of engineers and those associated with them, and an endowment fund has been provided so that the bells may always ring and every quarter hour be chimed. The music can be heard for miles across the lowlands of Belgium, and for generations to come it will carry its message of peace on earth and good will to men.

* * * *

Savings Bankers Indorse Private Ownership

FEW American bankers relish government ownership in any form. For this reason it is not surprising to find the National Association of Mutual Savings Banks issuing a stanch indorsement of private ownership and control at a recent conference of this body in Swampscott, Mass. Coming just at this time, however, such a pronouncement is doubly welcome to the power industry. Savings bankers are probably closer to the general public and its everyday aims and needs than any other financiers. To a remarkable degree they possess the confidence of the people, and rarely indeed has this trust been misplaced.

It is therefore gratifying to electric utilities that such a body, which has as its main objective the safe investment of the hard-won savings of millions of depositors, sees its way clear to making such an unequivocal declaration of the benefits of individual initiative as realized in the development of the electrical industry under private hands. Emphasizing the "remarkable efficiency" of our utilities, these bankers state their conviction that the same development could not have been accomplished under government ownership. In the words of this group, "regulation is infinitely better than public ownership"—using the word "public" in the governmental sense and not in its customer-ownership connection. It is also satisfying to find bankers commending the investment trust principle, and admission of utility securities as savings bank investments.

* * * *

Impressions of the A.I.E.E. Convention at Denver

LAST week electrical engineers gathered in Denver for the convention of the American Institute of Electrical Engineers. They had a good meeting and added further proof of the value of the Institute as an agency for progress. At the meeting of the chairmen of Institute sections and branches delegates from forty states discussed frankly the duties and obligations of engineers to help build a better profession and a better country. These men deserve the support of the industry.

Notable principles were enunciated by President Gherardi and President-elect Schuchardt. In his presidential address Mr. Gherardi said that the engineer and his works contribute the power and machines which produce the capital and leisure that make possible the cultural, material and spiritual values in modern civilization. President-elect Schuchardt urged each member to use his special knowledge and talents for civic good as well as for engineering advance.

Committee reports recorded recent advances in detail and are most valuable as summaries of the art. The technical meetings were splendid. The power group discussed recent field data on surges from lightning. Not many conclusions could be drawn, but in a short time the answer to the lightning problem will be had. Another technical meeting, on high-speed breakers, showed that railroad electrification is proceeding apace through the development of new equipment. The list of technical papers was representative of all branches of the art and recorded new things or better ways of doing old things. The engineers are alert to their economic responsibilities and are striving to advance their art as fast as possible.

A gifted pen should be devoted to the electrical engineer. He needs to have the notable things he has done translated into human values in terms of romantic achievement and adventure in pioneer territory. One of the handicaps of the engineer and of the industry is that

technical specialization is far in advance of the ability of the public to understand these engineering advances. It is sometimes said that the engineer does not understand the value of human relations, but it is equally true that most people do not understand the engineer or his works. Electric welding is needed to bind the electrical engineer to his industry and the public.

The Denver meeting again bore witness that the Institute is a vital and vigorous tool for industry progress. The electrical engineer, in a quiet and effective way, continues to provide the power and the machines that make for growth and advancement.

* * * *

A Service That Might Be Revived

WHAT has become of the so-called application engineer who formerly was maintained by the motor manufacturers to sell electric motors to industries? These motor specialists were trained in the application of motors to various machines and were engaged by manufacturers to show the value of electrification because the central-station company could not afford to carry them on the payroll. Today it is admitted by the manufacturers that these men have been allowed to drift away and have not been recruited since the war. The central-station power engineer, in most companies, has been trained to chase B.t.u.'s and to sell to the industries on the advantage of purchased power rather than of manufacture.

A recent survey conducted by the Census Bureau of Industries shows that the industries are now 75 per cent electrified. Great changes have taken place in power production during the last decade. It is not at all improbable that a great deal of good could be accomplished by once more sending the trained engineer into the manufacturing plant to see whether certain changes could not be made in the motor application, thereby improving load factors and power factor and completing the electrification of industries.

* * * *

Entering the Field of Fundamental Business Problems

LIKE every other great business, the electrical industry has a vital interest in the fundamental problems that, because they concern the whole industrial life of the nation, must necessarily concern every part of that life. Finance, production, distribution and sales, management, transportation, export trade are problems of this kind. Equally far-reaching are such major movements in legislation as those which cluster around taxation, tariff and government regulation. Industry in America is a vast, complicated machine, loosely adjusted and imperfectly tuned. Its component elements are as yet far from exemplifying in their relation one to another those ideals of progressive co-ordination, scientific dovetailing and elimination of waste and duplication that far-seeing business engineers cherish. Everything that brings the whole body of industry a little nearer to the attainment of these ideals helps all its parts, and every individual solution by one of these constituent parts of a specific problem of its own contains a lesson for the others.

These truths were in the minds of the executive heads of the McGraw-Hill Publishing Company of New York and the A. W. Shaw Company of Chicago when they agreed upon the merger of their interests chronicled and explained in our news columns last week. The merger is a significant event in the world of business publishing. It presages a virile development of an already effective service to the whole business structure of America.

Heretofore the magazine publishing activities of the McGraw-Hill organization have been confined to specialized service to engineering industries and the trade channels for distributing their products. Through the merger the McGraw-Hill institution enters the broader field of business economics and executive policy of American commerce and industry. In the words of Mr. McGraw: "It will fight for the interests of business, but it will place in an equally important position the responsibility of business to the public. It will, in a word, stand for true business statesmanship." We are sure that the men of the electrical industry will grasp the importance of this undertaking and will wish for it a gratifying measure of success.

* * * *

Healthy Business Situation Made Evident by Facts

THE general business situation is more healthy than at this time last year. Business activity has been maintained during the first half of 1928 on a virtually even level, and so far similar prospects greet the second half of the year.

New industrial building construction—an excellent index of business confidence—maintains a lead over that of 1927. Contracts for industrial building construction in the first five months of this year total $124,693,000, compared with $97,947,000 in the same period of 1927. There were 599 of these contracts as against 575 for the same period last year. The public utilities group leads with 53 jobs valued at $23,000,000, which is almost the exact figure for 1927. Record electrical manufacturing operations during May attest the activity in the electrical manufacturing industry. For the first five months of 1928 the average manufacturing operations were about 7 per cent higher than in 1927 as compared by the consumption of electrical energy. It is believed that the aggregate volume of industrial output in the United States during the first six months of 1928 is sure to exceed that of the same period a year ago.

Despite uncertainties which now confront American business in the political, agricultural and industrial fields, the outlook for the next several months is one to encourage optimism. Although there has been some hesitancy evident, there is no sound basis for believing that business will be hampered during the next few months.

* * * *

Standardized High-Tension Tests

SYSTEM insulation values are of major interest to all engineers at this time because of the growth of interconnection and the desire to improve service. Many systems have developed insulation values as a result of experiences differing widely from those of other systems with which interconnections have been made. Equipment manufacturers are faced with a wide diversity in system specifications for high-tension tests, and utility engineers find test results far from comparable because of the differences found in testing equipments and in test specifica-

tions. As a consequence it would seem possible to specify high-tension tests in more detail as to wave form, duration of impulses, energy of flashovers, control by resistance and reactance, regulation of test transformers and test procedures.

Several high-tension laboratories have been established in recent years, many data have been collected, and it is now possible to make test specifications that could be applied in any of these laboratories. It might also be worthy of consideration to concentrate elaborate high-tension test facilities for all branches of the industry under the neutral auspices of a university. Such a laboratory could do valuable research work and, under industry direction, could develop fundamental methods for insulators, bushings, cables, transformers and other high-voltage equipment.

Utility executives, manufacturers, consulting engineers, and in fact the entire electrical industry, should be interested in getting comparable results from high-tension tests, because in that way the answer to many economic engineering problems could be had. Millions of dollars can be saved if such a joint program is undertaken by the electrical industry.

* * * *

Precision in Wooden-Pole Calculations

AN "AVERAGE wooden pole," like an "average man," is a useful term but has little tangible meaning. Individual variations in tree growth combined with soil, humidity and temperature conditions make it very hazardous to attempt to use values of precision in the design of wooden-pole lines. Yet engineers who have dealt with the design of steel-tower lines are prone to use the same degree of precision in design and the same design methods when dealing with wood. This practice is both inadvisable and unnecessary.

A tree in the forest grows to maturity under the law of the survival of the fittest. It withstands the sleet storms, snow storms and winds of many seasons and has survived load and tests far beyond those to which it will be subjected when used intelligently as a transmission-line pole. Each tree has individual characteristics determined by its life history, and the testing of several trees for shear strength, rupture, compression strength and elastic limit gives values which vary widely. An average value determined from such tests must be used in conjunction with large factors of safety and a great amount of judgment. It is far more important for line designers to study conditions of temperature, soil and humidity in the territory where the line is to be installed, so that the proper kind of wood to use and the proper treatment for this wood may be decided from an economic point of view.

Service experience with wooden-pole lines has been very good, and at the present peak of extension of distribution lines there is renewed interest in wooden-pole line design. It is well to get more consistent data on wooden-pole strength, on the insulation value of wooden poles and on the value of modern methods of treatment. But this logical procedure should not obscure the fact that wood is not steel and that precision strength design based on average values may lead engineers astray. Ample factors of safety should always be used in designing wooden-pole lines, for they are obtained at a very low cost.

High Cost of Wiring for Ranges

LAST year 3,600,000 gas, coal and oil ranges were sold into the homes of America. In the same period only 110,000 electric ranges were sold, despite the fact that there were 7,776,064 houses to which range rates were available on January 1, 1928. What is the matter with the electric range that only 590,000 were then in use after all these years? Why doesn't the range sell?

The electric range today is a practical cookstove. It has been refined and perfected to a point where it is satisfactory in the kitchen. But there are five reasons why it has not been generally adopted in the home:

1. Absence of a range rate.
2. High cost of wiring for range.
3. High price compared with gas range.
4. Lack of effective selling.
5. Combination gas and electric utilities discourage sale to protect gas.

The rate situation is righting itself. Sales promotion is increasing. Combination companies are gradually recognizing that obstruction is not in the public interest and therefore is bad policy. The price of ranges can be expected to come down as more are manufactured. There is some daylight ahead on these four counts. But the cost of wiring for ranges is still a hurdle that is hard to jump. For at present the cost of connecting a range varies all the way from $35 to $110, and to add $100 or $75 to the cost of a range is very heavy handicap on sales. Therefore many men are asking what can be done about it.

At first thought it is natural just to condemn the contractor and say that such a spread of cost is a plain outrage. Studying into it, however, one finds that there are four factors that might contribute in different communities to a wide difference in the cost of wiring:

1. A variance in wage rate from 50 cents to $1.62½ an hour.
2. A wide variance in local codes.
3. Lack of standardization in methods even under one code.
4. Varying conditions of service in existing old wiring.

Each of these conditions would be reflected in a difference in cost—and therefore price—between two range jobs that were not parallel. By the adoption of one standard for range wiring for the entire country, and by the use of a standard unit that would perhaps embrace a 60-ampere switch and a distribution panel suitable for the average home, and by the development of more efficient labor methods, it should be possible to reduce the cost of range wiring materially. But because about one-half the cost of a range job is labor, there still would be a wide difference in price, in consequence of the wage scale. There seems to be little likelihood, therefore, that the cost of wiring for ranges will ever be the same in every city, nor is it necessary.

What the industry does need is a thorough study of present practice in range wiring and the causes of the high cost in so many cities. Out of such a study would inevitably come new standards and new methods that would make possible new economies. This is very much in line with the present study of municipal codes and ordinances and with the current interest in wiring costs. Surely anything that can help reduce the present expense of installing a range will, whatever it may cost to find it, pay the power industry and the contractors in the increased business that will come of it. Perhaps this is a job that the National Electric Light Association and the Association of Electragists should undertake together.

RUDOLPH F. SCHUCHARDT

President-Elect of the American Institute of Electrical Engineers

ELECTION of Rudolph F. Schuchardt, electrical engineer of the Commonwealth Edison Company, Chicago, to the presidency of the American Institute of Electrical Engineers is a merited honor to a man of outstanding ability and unusual versatility. Born in Milwaukee 52 years ago and graduated from the University of Wisconsin in 1897 with the degree of E. E., Mr. Schuchardt became a substation operator with the Commonwealth Edison Company in 1898, engineer of electrical construction for that company in 1906 and electrical engineer in 1916. The high degree of concentration that characterizes the Commonwealth Edison system has made his task one of great complexity as well as responsibility, and his successful handling of it has brought him high rank in engineering circles.

Joining the Institute in 1903, Mr. Schuchardt became a fellow in 1912. In 1922-24 he was a vice-president of that body. He is the author of a number of important technical papers contributed to its proceedings. Mr. Schuchardt has also been prominent in other engineering societies and has been active in the civic affairs of Chicago. His breadth of mind, industry, foresight and intellectual force equip him admirably to fill his new post.

Surge-Voltage Investigations

**Observations on six different systems reported at A.I.E.E. convention.
Effect of ground wires, choke coils and lightning arresters.
Polarity, magnitude, wave front and attenuation**

DURING the past year there have been extensive investigations of the surges produced on six power systems. These involved the Pennsylvania Power & Light Company, New England Power Company, Ohio Power Company, Consumers Power Company, Alabama Power Company and New York Power & Light Company. One whole session of the A.I.E.E. convention at Denver last week was devoted to a discussion of the findings. Valuable data have been secured as to the nature and polarity, magnitude, wave front and attenuation of the surges. Also on the effect of ground wires, choke coils and lightning arresters. Features of the observations are presented in what follows:

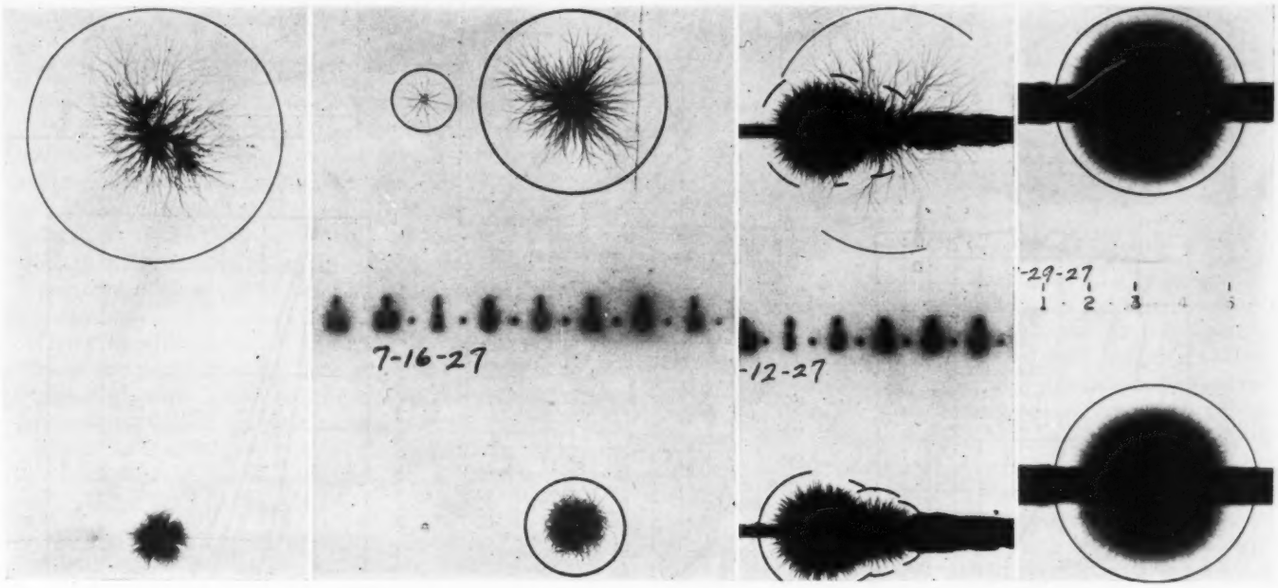
Some surge voltages due to lightning are unidirectional and some are oscillatory. Of the unidirectional surge voltages, some are positive and some are negative. Of the oscillatory surge voltages, some have positive characteristics predominating and some have negative.

While there may be a trend in some systems toward certain polarity characteristics, the surge voltages recorded on the New York Power & Light, Alabama Power, Ohio Power, Pennsylvania Power & Light, New England Power and Consumers Power systems are not exclusively of these characteristics, declared W. W. Lewis of the General Electric Company. It is certain that all unidirectional surge voltages of highest crest value are not of negative polarity, for several of positive polarity have been recorded. High-voltage surges of negative characteristics are in the majority, however.

Medium damped surges appeared only on one system, which operates with an isolated neutral. These surges reached a magnitude of 7.7 times normal and are thought to be associated with arcing grounds.

Surge voltages of the following upper magnitudes have been measured on the various systems: Due to lightning, seven to twelve times normal. Due to switching, two to five times normal. These values check those of previous investigations.

It has been fairly well established that the voltage is limited by the flashover strength of the line insulators, which on the average system is from ten to fourteen times normal (normal equals crest value of line to neutral voltage).



Four types of surges recorded—negative, highly damped, medium damped and slightly damped

Very little is known yet about the shapes of the waves encountered in lightning and other line disturbances. The wave front varies through wide limits. Of 154 surges examined, about one-fifth had fronts between one and ten microseconds, about one-fifth between ten and 100 microseconds and about three-fifths over 100 microseconds.

An empirical formula has been derived for attenuation. This is of the form $A = k\,e^2$. That is, the attenuation is faster the higher the voltage. The form of this equation is similar to that for corona loss, $p = c\,e^2$, and indicates that the attenuation is due mainly to corona loss.

The data as to the effect of choke coils and lightning arresters are meager and more information must be obtained along this line.

The data showed from 6 to 15 per cent difference of potential across the standard line choke coils.

Lightning arresters showed discharge currents varying from 150 to 2,600 amp.

In the coming year efforts are to be made to obtain more complete and exact data on a few systems. A special effort will be made to obtain data on wave shape, attenuation, effect of ground wires and effect of lightning arresters and choke coils.

The study has shown the benefit due to overhead ground wire in some cases to be very small and in other cases to be almost up to the theoretical value. A conclusive study is very difficult to make, as it is almost impossible to obtain two lines of identical arrangement, in identical territory, subject to the same lightning conditions, one with and one without ground wire.

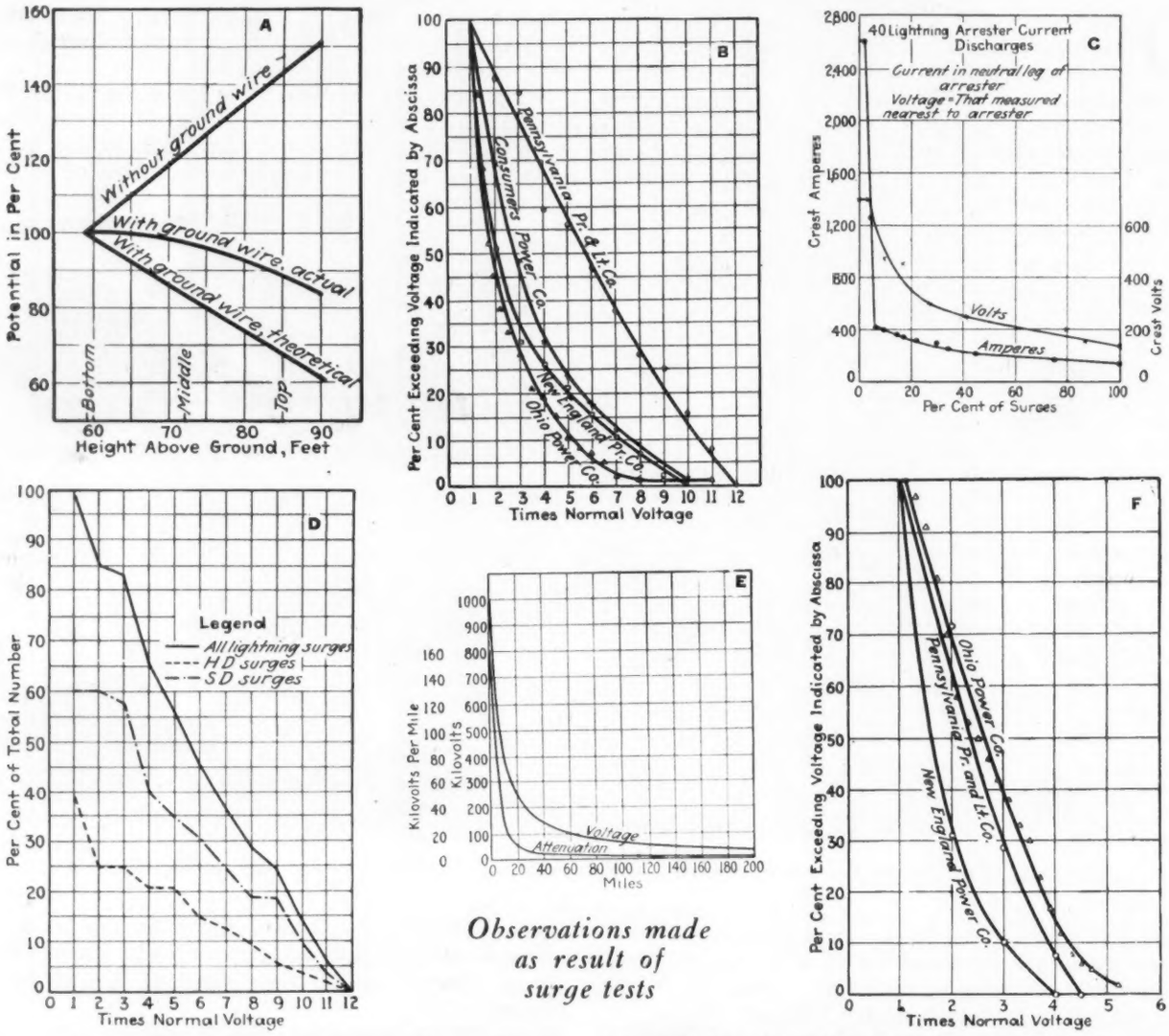
1925, 51 storms caused trip-outs and were recorded.

Fifty-six per cent of the lightning surges exceeded five times normal. There were comparatively few unidirectional surge voltages, although their magnitude was quite high. The majority of lightning surge voltages on this system were oscillatory, with no definite tendency for either the positive or negative wave to be higher.

All unidirectional voltages recorded had highly damped characteristics. The negative polarity prevailed in the highly damped oscillatory surge voltages in nine out of thirteen cases. The slightly damped figures, however, show only two of negative polarity out of a total of 30. The highly damped figures in no case show equal magnitude of positive and negative voltages, whereas twenty out of the 30 oscillatory slightly damped voltages are of equal positive and negative value. Line insulation apparently limited the magnitude of lightning surge voltages.

Not all of the maximum lightning surge voltages caused power arcs. No definite or reliable information was obtained on attenuation. The quantitative value of protection afforded by the overhead ground wire cannot be deduced from the limited data.

The highest surge voltage correlated to switching was



(A) Effect of ground wire on surge voltage; (B) magnitude of surge voltages due to lightning; (C) effect of lightning arrester discharge on surges; (D) magnitude of highly and slightly damped surges; (E) how surge voltages die off from point of origination; (F) magnitude of switching surges.

Surges on Wallenpaupack Line

During 1926 and 1927 surve voltages of a magnitude of 2,100 kv. were recorded during lightning storms on the Wallenpaupack-Siegfried 220-kv. line of the Pennsylvania Power & Light Company, declared Nicholas N. Smeloff. The records show that during the year 1927 35 of the total of 59 storms that were observed caused line trip-outs. For the year 1926, 40, and for the year

ORIGIN OF SURGE VOLTAGES (1927) (SMELOFF)

Origin	Number	—Highest Crest Value— Times Normal	Kv.
Lightning	48	11.7	2,100
Switching	21	4.0	720
From unknown causes		7.0	1,260
(a) Highly damped	29	4.9	880
(b) Slightly damped	51	11.7	2,100
Total	149		

four times normal (720 kv.), and practically all surges were produced by energizing the line. These surges were of the highly damped nature. Many surge voltages were recorded with no possibility of assigning a definite cause to them. These voltages reached an extreme magnitude of 11.6 times normal (2,100 kv.).

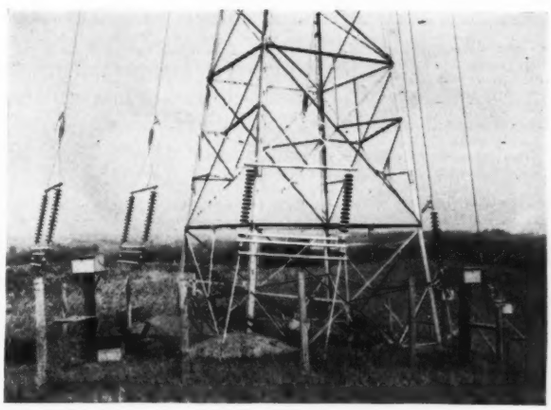
The surge voltage recorder study is being continued in 1928 and it is expected that more data will be obtained than in previous years. Experience with 220-kv. switching may also furnish some valuable and interesting information. With the assistance of laboratory research, it may be possible to determine the relation and condition under which a lightning flashover will be followed by a power arc.

Philo-Canton Line Experiences

Choke coils on the 132-kv. line of the American Gas & Electric Company from Philo to Canton reduced the lightning voltages recorded approximately 25 per cent, declared Philip Sporn, although tests on this feature are not extensive enough to prove this statement conclusively. Reflections at the choke coil may also have had a decided effect in altering the incoming voltage wave, so that this 25 per cent may not have been an actual reduction of the initial wave.

The protective value of the ground wire could not be proved conclusively from the data, due largely to the presence of slightly damped figures in the records. It is planned to continue this investigation in the coming year.

The record on instruments at the time of line trip-outs due to lightning (maximum 5.0 times normal voltage

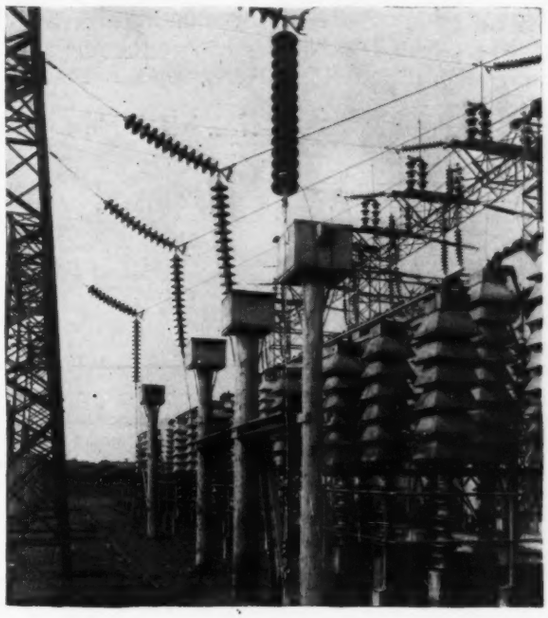


Coupling to 132-kv. Philo-Canton line for making surge records

is found) indicates that the voltages higher than recorded must have existed on the line for flashover to have occurred. This brings up the point that surge recorders must be placed in generous numbers on a line to study line performance thoroughly. A further tendency is indicated from these data; that is, that lightning voltages do not travel a great distance; otherwise there would have been recorded high voltages on some of the surge recorders.

The polarity of lightning surges indicated a preponderance of positive impulses. Of 96 surges 42 were positive, 25 negative and 29 highly damped.

Transient voltages on the ground wire at the tower



Surge recorder installation at Canton substation

were recorded as high as 8,200 volts negative during a lightning storm, and in all cases were of the order of 3,000 to 4,000 volts. These surges were recorded at times of lightning storms and switching; in some cases no cause could be found. This relatively low voltage on the ground wire compared with the higher voltage on the line is positive evidence of the effectiveness of the ground wire in reducing the impulse voltages on the line itself.

Lightning arrester discharges in all cases were of the general order of 200 to 400 amp., although two cases were recorded as high as 1,260 and 2,620 amp. Measured currents were in all cases the sum of the currents in all three legs of the arrester. The highest recorded current was negative; the 1,260-amp. value was highly damped, being initially negative.

Attenuation of lightning surge voltages failed to give any conclusive results largely on account of the presence of slightly damped figures.

The attempt to determine voltage changes at the termination of the ground wire was not very successful due largely to insufficient reliable data and the proximity of the test point to the substation where the numerous changes in surge impedance introduced the question of reflected waves.

Switching surges have been recorded as high as 5.2 times normal, which seems to be in general agreement with previous results. Over 50 per cent of the switching surges were of the order of 2½ times normal to ground or higher. By isolating switching surges in four special tests, it was shown that the surge voltage on de-energizing the line was approximately twice as great as on energizing the line. Switching surges are mostly of a highly damped nature, as shown by the data.

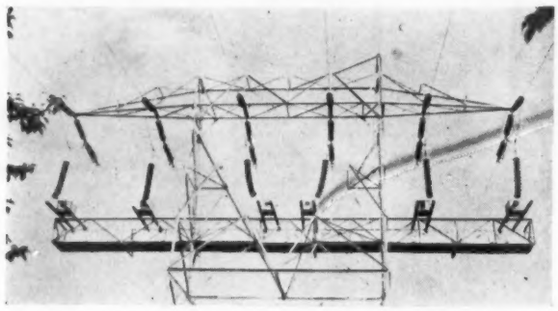
No voltage was recorded between the base of a tower and ground, during the tests, although the voltage at the

peak of the tower to which the ground wire was attached indicated surge voltages up to 8,200 volts.

The relative lightning voltage on parallel conductors is shown to be equal, although the data are too limited to prove this point definitely.

It was shown that the two types of surge recorders are equally reliable from the point of view of measuring surges, but it was also shown that the type of coupling employed to connect the instruments to the line must be carefully studied and selected or erroneous conclusions may result.

This investigation, it is believed, has resulted in some



Surge recorders on 110-kv. New England Power line

new information, some confirmatory and some negative. All this information is valuable, although a great deal more data must be obtained properly to solve the lightning problem. With this data, together with the data it is hoped to get during the 1928 lightning season, it is believed some further light will be thrown on the lightning voltage situation.

Lightning produced voltage surges whose magnitudes were as high as 1,100 kv. on the 140-kv. lines of the Consumers Power Company between Saginaw River and Flint in 1927, according to J. G. Hemstreet and J. R. Eaton. During this particular investigation all surge voltages of appreciable magnitude due to lightning were recorded on the two-electrode instrument as oscillatory, with no preponderance of positive or negative polarity indicated. In a number of cases the record of the surge from the lightning itself was undoubtedly considerably obscured by secondary oscillations from arcing grounds and circuit-breaker operation.

The surge voltages due to lightning were characterized by three different figure types, highly damped, medium damped, and slightly damped.

Surge voltages characterized by medium-damped figures showed very little change in value from station to station and were frequently correlated with arcing grounds and switch trip-outs.

Comparison of simultaneous registrations of highly damped and slightly damped surge voltages showed the reduction in voltage from station to station to be of the order of 50-kv. per mile. From insulator flashover, the attenuation appeared to be in the order of 100 kv. per mile.

The data indicated that the ground wire afforded some protection against lightning disturbances. No definite relation was shown between conductor height and voltage recorded.

Surge voltages recorded coincident with switch trip-outs due to lightning frequently were of a magnitude less than 400 kv., though higher voltages undoubtedly existed on the line at points remote from recorder stations.

Lightning surges which produced no switch trip-outs were, as a rule, very limited in their extent, although they were frequently of a very high value (800-1,100 kv.).

Under lightning conditions, voltages in excess of 35 kv. were built up between ground wire and ground at mid-span, without excessively high voltage on the line conductors. The voltage from ground wire to ground was always considerably less at the tower than at mid-span.

Normal switching operations produced surge voltages of low value which extended over considerable length of line.

Numerous surge voltages were recorded which could not be correlated with lightning storms or system switching. The magnitude of such disturbances was relatively low, reaching values no higher than 5.7 times normal (650 kv.).

On the 110-kv. Harriman-Millbury line of the New England Power system practically all surge voltages of appreciable magnitude due to lightning were unidirectional or highly damped and of negative polarity, reported E. W. Dillard. No switching surge of greater than four times normal was found.

The maximum voltage of a lightning disturbance does not seem to be impressed over more than a very limited portion of the line. More study should be given to this point.

The data collected by the surge-voltage recorder do not allow definite conclusions to be drawn relative to ground-wire protection. Other data from operating records indicate worth-while protection.

Cost of a Switching Station

IN AN Eastern state a switching station was recently built to control energy received from two 110-kv. circuits and two 66-kv. circuits as well as two outward bound 66-kv. circuits. Three 17,000-kva. auto-transformers were provided to tie the two sets of lines together, and the installation, now about to go into service, includes a switchboard and control house, tower for transformer maintenance and various auxiliary apparatus. The estimated cost of the job is given in the accompanying table.

SWITCHING STATION COSTS

Land and grading	$7,600
Foundations and footings	15,200
110-kv. steel supports	14,100
110-kv. oil switches	54,300
110-kv. lightning arresters	17,400
110-kv. potential transformers	4,800
110-kv. wiring	27,100
Auto-transformers (three, 17,000 kva.)	87,000
66-kv. steel supports	12,500
66-kv. oil switches	59,500
66-kv. lightning arresters	5,400
66-kv. potential transformers	4,300
66-kv. wiring	19,500
Transfer truck and hoist	3,200
Cooling tower equipment	8,100
Oil and water piping	6,200
Switchboard	11,800
Control conduit and cable	13,000
Storage battery for control service	4,800
Local 15-kv. equipment	4,300
Station building equipment	21,700
Station service	1,000
Lighting equipment and installation	1,600
Track and siding	4,300
Fencing, painting and screening	3,200
Total	$411,900
Contractor's expense	41,200
Engineering expense	22,700
Total	$475,800

Mount Evans as seen through Bear Canyon, Colorado, a point on the A.I.E.E. itinerary

A·I·E·E· Summer Meeting

Lightning surges and high-speed air breakers received most consideration at Denver meeting. Diversified program attracted large attendance

MORE than 500 electrical engineers from 40 states attended the summer convention of the American Institute of Electrical Engineers at Denver, June 25 to 29. A diversified program of technical papers, reports of committees, a conference meeting of sections and branches, notable addresses and a splendid series of entertainments and sightseeing trips produced a splendid convention.

On Monday the section and branch delegates met in an all-day discussion of Institute affairs. Features of this meeting were the hearty indorsement of regional conventions and a discussion of methods to secure a better balanced grouping of members into the several classes of membership at this meeting. President-elect R. F. Schuchardt gave a splendid talk on the social responsibilities of engineers and urged that they translate their material accomplishments into terms of public service and public understanding.

The formal opening of the convention occurred on Tuesday morning. Mayor Stapleton of Denver welcomed the members to the city and then announcement was made of the vote on constitutional amendments and officers for next year. All the constitutional amendments were carried and Secretary F. L. Hutchinson stated that the Institute membership on May 1, 1928, was 18,265.

Balloting for new officers resulted in the following elections: President, R. F. Schuchardt; vice-presidents, E. B. Merriam, H. A. Kidder, W. T. Ryan, B. D. Hull and G. E. Quinan; managers, A. E. Bettis, J. A. Johnson and A. M. MacCutcheon; treasurer, George A. Hamilton. Following this announcement telegrams were read by President Bancroft Gherardi which congratulated President-elect R. F. Schuchardt on his new honor and for his 30 years of service with the Commonwealth Edison Company. Those sending telegrams included L. A. Ferguson, J. F. Gilchrist, Peter Junkersfeld, E. W. Lloyd and others. Mr. Schuchardt expressed his appreciation of the high honor conferred upon him and of the kind remembrance of his friends in a few appropriate words, after which President Bancroft Gherardi gave his address on "Civilization and the Engineer."

Mr. Gherardi said the standing of the engineer depended upon his contributions to civilization. He traced the growth of science from the pioneer days of Galileo and Newton and showed that power and machines are the basic agencies for supporting modern standards of living. These enable man to increase his margin to produce those things that are more than his primary needs and thus create capital. He pointed out that the nature of engineering involves dealing with material things, but that these also have spiritual values, as instanced by radio, automobiles, light, telephone and many other contributions.

The development of culture in any peoples requires leisure from the struggle for existence and the engineer

and his works make leisure possible. History shows that a high degree of widely distributed culture must be associated with a high degree of equally extensive material prosperity. Even the educational system is impossible to maintain at present standards without the contributions of the engineers.

Lightning Surges Discussed

The protection of transmission systems from lightning is a major industry problem and has involved field investigation on a large scale. At the Tuesday morning meeting a group of papers was presented covering results of field investigations on several transmission systems. The basic principle used was the Lichtenberg figures indicated on several types of surge recorders installed on transmission lines. Surges were found of magnitudes up to twelve times normal due to switching, lightning and other transitory phenomena. Only highly damped surges reached high values and many of the data were indefinite.

A paper by W. W. Lewis covered results obtained on several transmission lines. He concluded that some lightning surges are unidirectional and some are oscillatory and that both types may be positive or negative. Surge voltages due to lightning were found to be seven to twelve times normal, while those due to switching were two to five times normal. The surges seemed to have wave fronts varying from one-fifth microsecond to over 100 microseconds. Lightning arrester discharges showed currents varying from 150 to 2,600 amp. and line choke coils gave from 6 to 15 per cent difference of potential across their terminals.

N. N. Smeloff gave data on the 220-kv. Wallenpaupack line of the Pennsylvania Power & Light Company. He stated that lightning surges of 2,100 kv. were observed and that the majority of surges were oscillatory and that the highest switching surges were 720 kv. No definite conclusion as to the value of the ground wire could be made from the limited data.

E. W. Dillard gave data obtained on the New England Power Company system. He said all surges of magnitude were found to be unidirectional or highly damped and of negative polarity and that no definite conclusion about ground wire protection could be made.

J. G. Hemstreet and J. R. Eaton gave data from the 140-kv. system of the Consumers Power Company. This is an isolated neutral system and the data showed surges up to 1,100 kv. All surges of magnitude were recorded as oscillatory with no predominance of polarity. The data indicated the ground wire afforded some degree of protection.

Philip Sporn gave data on the American Gas & Electric Company's 132-kv. system in Ohio. The protective value of the ground wire was improved, choke coils reduced lightning surges about 25 per cent, a preponderance of positive impulses were found and lightning arrester discharges were of the order of 200 to 400 amp. The author said great care should be used to see that the surge-measuring device did not, in itself, cause surges to be recorded which were erroneous.

The brief résumé of these papers show clearly that more work must be done before many positive conclusions can be made. In discussing these papers many contributions were made by members present, but little positive evidence was added to that already presented. J. F. Peters and J. H. Cox accented the necessity for eliminating instrument errors. They said a string of insulators used in connection with a surge recorder had improper constants for accurate measurements and would introduce oscillations which would be recorded as line oscillations. F. C. Hanker said a cathode-ray oscillograph was being installed on the lines of the Aluminum Company of America in Tennessee, and it is hoped this would give valuable data on surges. L. L. Perry asked several questions as to the effectiveness of arresters and ground wires. A. O. Austin gave several slides of construction and presented the theory of ground wire protection on a properly constructed line. Several transmission engineers contributed experience data on lightning surges and the authors closed the discussion by elaborating on the data given in the papers.

Committees Record Progress

On Wednesday morning the chairmen of the technical committees presented reports on the work of the year. Two parallel sessions were held and many splendid reports were presented. Prof. V. Karapetoff, chairman of the electrophysics committee, gave a summary of activities in this branch of the art. The dividing line between engineering and pure science is difficult to outline and many handicaps to engineering progress can be overcome only through a purely scientific study of the phenomena involved. Corona, the electric arc, X-ray analysis, ferromagnetism, radio, acoustics, magnetic and electrostatic fields, dielectrics and temperature are typical topics that baffle the engineer and scientist, and yet progress is made each year in reaching an understanding of the phenomena.

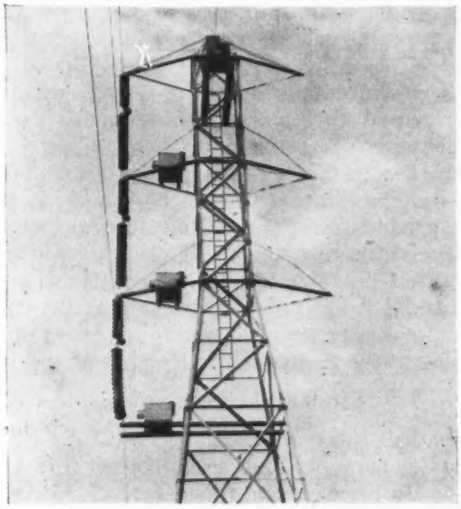
W. S. Lee, chairman of the instruments and measurements committee, presented a report covering developments in measurements. High-tension metering is being studied seriously, as it is an important problem and much work is being undertaken to measure high frequency. The chief topics of interest to engineers in measurements were noted as: (1) Measurements of variable power and large blocks of energy; (2) dielectric power loss and power-factor measurements; (3) measurements of non-electrical quantities by electrical means; (4) high-frequency measurements; (5) remote metering. Progress was recorded in all these divisions and the precision notable in the electrical engineers' normal measurements will soon be extended into these new fields.

Communication Advances

Communication has made many advances during the year, reported H. W. Drake, chairman of the committee on electrical communication. Printing telegraphs have increased in use and over 800 are now used. Ocean cable telegraphy is growing automatic, ticker instruments for market quotations have been speeded up greatly, telegraph repeaters are largely regenerative and more than 500,000 dial telephones were installed during the year, giving a total of 2,900,000 of these stations in operation on Jan. 1, 1928. This is about 16 per cent of the residential telephones. Toll service to Mexico and extended service to other countries were cited as advances and carrier current systems increased in use and were simplified greatly. This carrier system is being adopted by power companies for many purposes other than communication. Sound reproduction, radio and police and fire signal systems were other topics discussed by the committee.

P. S. Millar, chairman of the committee on production and application of light, said the year had witnessed refinements of equipments and methods and an extension of lighting service. Very small 10-watt lamps with $1\frac{3}{8}$-in. diameter bulbs are now available and the upper limit is 10 kw. at present. Decorative lamps are avail-

able in greater variety and the use of incandescent lamps for projection purposes is increasing. In the application of light there is a distinct trend to decoration as well as illumination and many very artistic fixtures are available. Home lighting was said to be handicapped by high costs, resulting from ill-advised code requirements. In several fields of application to interior and exterior illumination the report showed greater use of light. Along with this tendency have followed scientific and engineering studies to find out how to use light more intelligently and the art is becoming precise in applications to all fields. The gas-filled lamp continues to be used and low-voltage lamps have been developed. Therapeutic lamps producing ultra-violet rays are being used in large numbers and great developments are under way to standardize traffic control lights. Lighting for aviation, lighthouses,



Surge recorder on 140-kv. line of the Consumers Power Company

night recreation and many other applications was discussed in this very fine summary of the status of light and lighting.

In the field of electrochemistry and electrometallurgy rapid advances have been made both in standardizing and in discovery of new applications, stated George W. Vinal, chairman of this committee. Storage battery standards have been revised and international electrical units and standards have been checked. New fields for applying electrochemistry and electrometallurgy are opened in making batteries of new or better materials, in the development of satisfactory electrolytic aluminum condensers, in an electrical distillation method for making pure hydrochloric and nitric acids and in electrical precipitation of oils from hydrocarbon gases. Increased use for electricity is brought about by melting and heat-treating metals and electrolytic refining is gaining in favor because market requirements are for pure materials and these may be had only through electrolytic processes. Electric annealing and heat treating is being extended rapidly in industry and electrolytic zinc and chromium plated devices are two very large and new industrial developments for which electricity is responsible. There is a revival of commercial interest in many branches of activity in the fields of work covered by this committee and the future is very promising.

In electrical machinery many advances were recorded in the report presented by F. W. Newbury, chairman of the electric machinery committee. Notable trends during the year were the great advances made in the design of transformers, especially those with facilities for changing taps when under load; a second great trend is the use of structural steel and welding in the fabrication of all machines, and a third outstanding trend is the rapid introduction of mercury-arc rectifiers. Welded steel machines result in saving large sums; they speed up deliveries and give a better machine. This type of construction is being adopted wherever possible. In all lines of machines improvements have been made chiefly to get a cheaper and better device. Closed circulation systems are growing in favor and gas-cooled machines are being built. Temperature ratings for certain machines are being discussed and standardization and simplification are being sought.

At the end of 1927 there were 53 mercury-arc rectifiers in use in the United States and Canada. These aggregated 44,450 kw. in capacity. The entire world capacity in use is 700,000 kw. Of the American installation 50 are in railway use and six in industrial use. Rectifiers of large capacity are being designed and this new device is expected to advance in favor.

Transmission and Automatic Substations

As always, power transmission and distribution are of paramount importance to engineers of the industry, stated Philip Torchio, chairman, in opening the session for presentation of reports on these subjects. The principal work of the protective devices committee (F. S. Hunt, chairman) this year has been arrnging for an actual presentation of papers at Institute meetings and the preparation of standards. A comprehensive set of proposed standards for lightning arresters was prepared by the sub-committee on lightning arresters. These covered unusual service conditions, definition of terms, classification, rating, characteristics and performance tests for protective characteristics and dielectric tests.

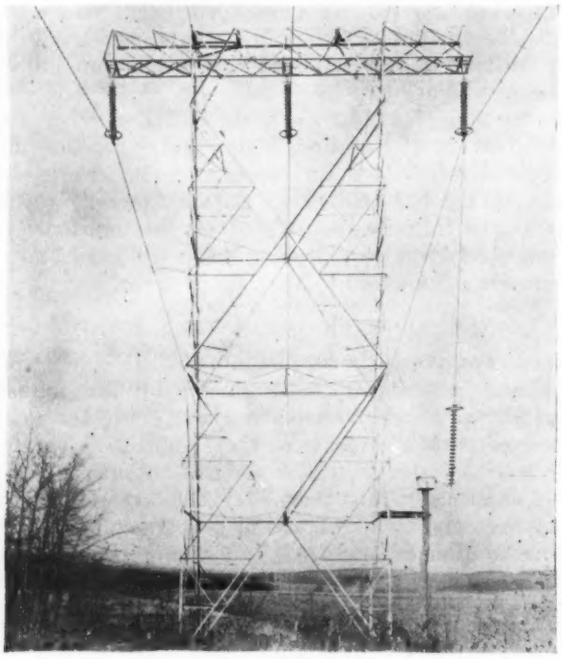
Two interesting developments in current-limiting reactor practice involving the use of reactors which are oil-immersed in steel tanks were reported by the subcommittee on current-limiting reactors. One development involves the use of a three-phase, oil-insulated, self-cooled reactor, while the other involves a single-phase, oil-insulated and water-cooled unit. The advantages claimed for these designs are that foreign material cannot be drawn into the windings and that the equipment can be used with the highest factor of safety, either for indoor or outdoor service.

The work of this year's sub-committee on relays has consisted chiefly of reviewing the work of previous years and attempting to crystallize work which has been started. Few comments were received on tentative test specifications proposed by last year's committee and a set of acceptance tests was again offered for consideration.

The first report of the committee on automatic stations (Chester Lichtenberg, chairman) since appointment of the committee in April, 1927, was presented. It gives a general description of automatic station development during the past decade and deals with some of the more important features brought out during the past year. Research, operation, standards, bibliography and suggestions for future study will each receive attention. Research has been carried forward by operating and manufacturing companies with the assistance rendered by several universities. Development has been directed toward simplifying operating sequence, reducing the

number of devices required for various classes of equipment and making the operation more positive and reliable. Supervisory systems for control of remote power apparatus have reached a high state of development, many refinements have been incorporated and these systems are now considered to have an important field of application. Telemetering and power rectifiers are promising new developments.

The committee on general power applications (A. M. MacCutcheon, chairman) endeavored to keep in touch with the developments relating to general power applications, foresee the need for development of new electrical



Surge recorder on 220-kv. lines of Pennsylvania Power & Light Company

apparatus to meet new conditions in general power applications and develop papers to be presented before the Institute. Details of specific applications were taken up, including marine equipment; electric railways; mining; glass, paper, steel and oil industry; refrigeration and electric furnaces. Notable advances were made in control equipment during 1927. The year saw improvement in thermal overload relays for motor protection and in magnetic switches. Much has been learned with respect to the characteristics of different metals used as contact point and also with regard to the advantages of multiple-break contacts.

There is every indication that the mechanization of mines is making great progress, according to the report of the committee on application to mining work (W. H. Lesser, chairman). Overproduction facilities in men and mines, labor problems and freight rates are factors which are vitally influencing the prosperity and accomplishments of the business. Comprehensive dispatching systems, introduction of larger mine cars and heavier locomotives and mechanical loading are reducing haulage costs. Mine managers are giving more attention each year to maintenance and care of electrical maintenance costs and better operating efficiency. Frequent inspections of the mine by the engineer and the electrician, together with a good operating organization, materially reduce the number of equipment failures, so disastrous to good production.

Activities of the committee on applications to marine work, under the chairmanship of W. E. Thau, were devoted chiefly to dissemination of A.I.E.E. Marine Standard No. 45. These standards are recognized by the various marine classification and insurance societies, naval architects and marine engineers and are incorporated as one of the regulating provisions in their specifications. As a result of the committee's efforts 750 copies were sold last year.

Application of electricity to transportation proceeded during 1927 at a healthy rate and new developments in apparatus and equipment continued, several interesting applications being introduced during the year, states the report of the transportation committee (J. V. B. Duer, chairman). A number of new main line and terminal electrifications are discussed in the report and the use of Diesel-electric, gasoline-electric and storage-battery locomotives were pointed to as interesting recent developments.

J. C. Lincoln, chairman of the electric welding committee, reported that marked progress has been made during the past year in the application of electric welding to an increasing number of industrial uses, including welding of pipe lines, structures and cracking stills for gasoline production. Several outstanding applications were given in the report, notably electric welding of the 90-mile, 66-in. pipe line for domestic water supply to the city of Oakland, Calif. During the year the committee arranged for the presentation of four papers on electric arc welding at the midwinter convention of the Institute.

High-Speed Breakers

At the Wednesday afternoon technical session a symposium of papers on high-speed circuit breakers was presented. In his paper on this subject J. W. McNairy, General Electric Company, described a 12,000-volt, 1,500-amp., single-phase, air-break circuit breaker having a speed of operation comparable with the direct-current type. Under test the breaker has successfully interrupted a current of 24,000 amp. r.m.s. at 14,000 volts repeatedly. A feature of this breaker is the use of high-resistance arcing horns of special material designed to absorb a considerable voltage as the arc is forced along them, under the action of the blow-out coils. It is expected that the application of high-speed air breakers to alternating-current railway systems will greatly minimize the effects of short-circuit stresses on transformer and generator windings and will limit burning of insulators, conductors or parts of motive equipment in the same manner as in direct-current applications and with the same degree of protection and selective operation. It is expected, also, that high-speed alternating-current breakers will greatly reduce inductive interference in communication and signal circuits adjacent to the railway by greatly lessening the duration of short-circuit currents. The method of applying the magnetic type of mechanism previously used for direct-current breakers to the alternating-current type breaker and the theory of the saturated transformer type of trip circuit used for this purpose are also discussed.

"High-Speed Circuit Breakers for Railway Electrification from the Design Point of View" was the subject of a paper by H. M. Wilcox.

The author took up the mechanical and electrical problems involved in the design of both direct-current and alternating-current high-speed breakers for railway oper-

ation and described a high-speed oil circuit breaker developed by his company for railway service. It is rated at 15 kv., 1,500 amp. continuous load at 25 cycles and has an interrupting capacity of 50,000 amp. at 12 kv. The breaker is essentially a single-pole oil circuit breaker of the conventional gravity type but differs from the normal-speed oil breaker in that it carries a high-speed shunt-tripping device, has provision for a high acceleration of the moving contact, an auxiliary magnetic blowout circuit for lengthening the arc rapidly and is actuated by a specially designed high-speed relay.

The conclusion is drawn that from the design point of view adequate high-speed breakers can be supplied to meet present and future requirements for machine protection in direct-current railway circuits. Also, adequate high-speed breakers can be supplied to meet the requirements for protection of 25-cycle, single-phase railway electrification work up to 12,000 volts. High-speed alternating-current breakers for the next step or two in operating voltage above this seem within easy reach, although not developed at the present time due to a lack of demand. Alternating-current breakers of the type described for high-tension circuits or for multi-phase circuits at any voltage are not at present available and seem to present problems requiring considerable development work before they may become available.

Operating experience with three high-speed oil circuit breakers installed in 1925 on a branch line of the New York, New Haven & Hartford Railroad was given in a paper by B. F. Bardo, superintendent of electrical transmission for the road. The three breakers are rated at 16,500 volts, 800 amp., 25 cycles and have a maximum interrupting capacity approximating 35,000 amp. Oscillograph tests showed that they will break short-circuit currents ranging in value from 540 amp. to 3,030 amp. in from ½ to 1½ cycles. A record of operations up to Jan. 1, 1928, showed: Total operations on grounds, 717, average operations on grounds per breaker, 239; total number of other operations, 750; average number of other operations per breaker, 250. The circuit breakers have not operated faultlessly and therefore the third, or spare, has been of real use. On the breakers as a group there have been a total of 25 operating failures since their installation, distributed as follows: Trip coils, five; mechanical parts, five; closing motor, two; overload relay, one; indicating switch, two; high-tension terminal, one; unknown, nine; total, 25.

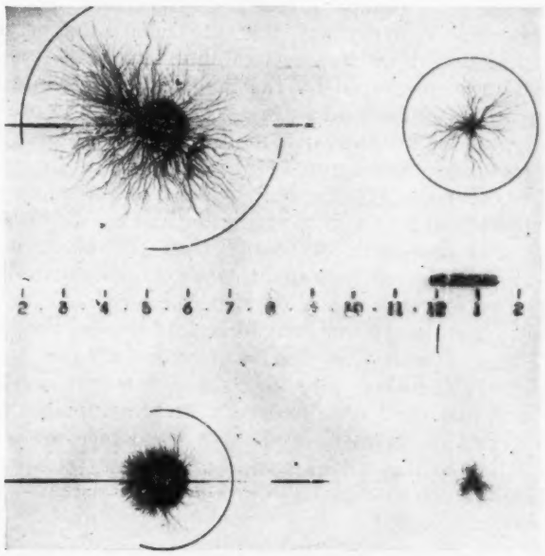
Many of the causes of these failures have been eliminated and in general the statement is justified that most of the operating faults uncovered would not have appeared if the manufacturer had been given more time to develop the design and test it completely before installation.

A description of conversion and distribution facilities as recently installed in the electrification of several Eastern railroads was given in a paper by R. B. Morton. The author also took up the general requirements governing arrangement of distribution system and substation equipment for electrified railroads.

A paper by E. H. Brown, Pennsylvania Railroad, discussed the requirements for protecting the high-tension circuits and equipment on locomotives using the single-phase, alternating-current system. Experience of the Pennsylvania road with pantograph-lowering relays in lieu of a high-tension circuit breaker on the locomotive justifies elimination of the locomotive breaker. It is felt that the additional investment required and the difficulty of providing space on locomotives for circuit breakers of the proper size is unwarranted, and that such breakers may be eliminated by the use of pantograph-lowering relays, making use of the opening of the substation breaker to disconnect the electrical equipment on the locomotive from the line during lowering of the pantograph. Recent types of relays have been developed which are sufficiently sensitive and rapid in operation to be used with high-speed substation circuit breakers.

Operating experience as a whole with high-speed circuit breakers on the Illinois Central Railroad was reported quite satisfactory in a paper by W. P. Monroe and R. M. Allen.

Advantages stated were: The inductive shunt principle and directional characteristics of high-speed breakers make automatic isolation of trouble by selective



Record of two highly damped surges from lightning on New England system

operation simple and almost 100 per cent; high-speed breaker operation reduces to a minimum the damage to train equipment and overhead. The authors point out that theoretically there is an inherent defect in the high-speed breaker characteristics as applied in this service with a short circuit occurring at the time of heavy traction load. When the breaker is carrying heavy current in the right direction for its operation and a short circuit occurs on an adjacent section not directly fed by the breaker there is a possibility of the breaker opening automatically and incorrectly from the selective standpoint. This is due to the load current superimposed on the short-circuit current, the effect being to lower the critical rate of current increase which will open the breaker on short circuit.

Actually, however, there have been very few incorrect operations due to this cause. The authors conclude that the advantages of their installation of high-speed circuit breakers undoubtedly outweigh the disadvantages.

In discussing the papers F. C. Hanker said the railway circuit has less inductive effect under fault conditions than a power circuit for the same exposure, but that faults were more frequent in railway service. If the fault energy is large the high-speed breaker lessens the inductive effect. Sidney Withington said high-speed breakers on the New Haven railroad had given very satisfactory service over a period of years. They clear

faults quickly, prevent inductive effects and lessen hazards to apparatus. The practice on this road is to hold in the locomotive breakers until the sectionalizing breakers clear the fault section. The high-speed relay now available will greatly improve breaker application. H. B. West said the major function of the high-speed breaker was to limit the rotor-displacement on a synchronous converter. Under short-circuit conditions the direct current rises rapidly, but the alternating current comes in at a rate fixed by changing rotor displacement. When the direct current is interrupted suddenly there occurs an unbalance and flashovers may result. Thus a high-speed breaker must not interrupt the current instantly, but at a rate which will help to prevent flashovers. This is done by shunting a series resistance with the high-speed breaker so that the change in current is proportional to change in rotor displacement.

J. B. MacNeill declared that the value of a breaker was determined by its serviceability and that the depreciation is measured by the magnitude and duration of the arc. Both oil and air breakers have been improved greatly, but air breakers take more space and do not have the same insulation factor. If a railway line is insulated for 100,000 volts, experience indicates that apparatus will be subject to surges of this magnitude and the air breaker meets this condition less easily than the oil breaker. Also, the data given indicated the switch generated 1 kw. of energy for each 2 kw. of energy interrupted on the circuit. This heavy duty would be less if a breaker was used which opened at the zero value of the wave. Chester Lichtenberg said high-speed breakers are not new and that their use involved a study of applications. Many combinations of relays with mechanical or magnetic latching of breakers could be used and the specific application determined largely which to select. Much discussion occurred on relay control of the breakers and on design features of breaker contacts.

Friday morning concluded the last technical session of the convention. Percy H. Thomas, consulting engineer, New York, made a contribution in the form of a paper for the purpose of deriving a logical formula to be used as a guide in the determination of the minimum safe horizontal spacing of transmission line conductors which will insure safety against short circuits due to swinging under the influence of wind. Many erratic factors bear on the danger of contact between conductors horizontally spaced, so that apparently experience data rather than mathematical calculation must be the final dominating consideration. However, these experience data are exceedingly scanty and difficult to interpret, so that a theoretical analysis is likely to be of real value. It may be assumed as an approximation that the danger of deformation of the catenary and contact in the span depends apparently more upon tension in the cable and configuration of the ground than anything else.

Transmission Experience in Colorado

A paper by M. S. Coover and W. D. Hardaway dealt with operating experience with the transmission system of the Public Service Company of Colorado. Electrical and mechanical failures of the 100,000-volt line from the Shoshone hydro-electric plants to Denver during the nineteen years the line has been in service were discussed. The line crosses the Continental Divide and negotiates three passes ranging in elevation from 11,500 ft. to 13,700 ft. Snow and ice conditions are unusually severe, winter temperatures go as low as 52 deg. below zero and wind velocities as high as 165 miles per hour have been recorded. In spite of these adverse conditions mechanical and electrical failures have been reduced to the point where there were only 60 failures during 1927, 35 of which were caused by lightning. One of the most important factors in reducing outages has been an increase in line insulation, from the original installation of four insulator units in both suspension and dead-ends to five units in suspension strings and six units in dead ends. Addition of one more unit on both suspension and dead-ends in 1916 decreased the number of flashovers approximately 75 per cent.

Lightning remains as the chief unsolved problem on this and other transmission lines of the company and is responsible for anywhere from two-thirds to all of the interruptions during a year. During 1927 62.9 per cent of all outages on the transmission system were caused by lightning. From observations to determine the value of a ground wire the company decided that a ground wire properly installed is an essential adjunct to the system.

Arcing points appear to be desirable at both ends of insulator strings; copper and steel conductors operating above the critical corona voltage for years show no unusual depreciation; horizontal configuration appears to be more desirable than vertical configuration; jumpers at dead-end towers should be supported where wind velocities are high. These were among the conclusions drawn.

M. T. Crawford said that a 110-kv. line operated in Washington under similar severe conditions had proved entirely successful after elimination of several mechanical weaknesses. Elimination of all dead-ends on this line has practically solved the problem of mechanical failures due to jerking of the conductors from ice dropping.

Several of those who discussed the paper cited evidence to show the value of ground wires in regions where lightning is frequent and said that experience papers of the type presented were of especial value.

Alternating-Current Elevator Motors

Problems of design and characteristics of alternating-current elevator motors of the squirrel-cage type were dealt with in detail in a paper by R. E. Dreese, Lincoln Electric Company. The induction motor as developed for elevator drive is a highly specialized machine. Slip-ring motors have been used, but the complications of control and the difficulty of eliminating noise have caused them to give way to the high-resistance squirrel-cage type. The high-resistance rotor gives a speed-torque characteristic which insures that the motor will have no points of mechanical instability and the motor will not pull out and stall. For a low-speed elevator the stator is usually wound for a single speed. For higher elevator speeds, the motor is built for two speeds, since it is more difficult to make accurate landings. Common speed ratios are 2:1, 3:1, 4:1 and 6:1.

The growing demand for alternating-current elevators is a natural consequence of the tendency to eliminate direct current and there is every indication that the use of alternating-current elevators is in its infancy. As use is extended design problems and their solution will represent a substantial start in the more economical use of power and invested capital in this particular field.

A paper by J. D. Wright on electric welding of pipe lines described one of the newer applications of automatic arc welding in the fabrication of pipe from rolled steel plates. An example cited was the electric arc welding

of an 8-mile pipe line varying in diameter from 36 in. to 54 in. and in thickness from $\frac{5}{16}$ in. to $\frac{1}{2}$ in. Longitudinal welds made in the shop using the multiple-arc process resulted in a very substantial reduction in cost and a superior finished product. Reduced cost is secured not alone by decreased weight of steel required but also by reduction in the work of fabrication. Moreover, a smoother inside surface is obtained and circumferential joints are more easily made than with riveted pipe.

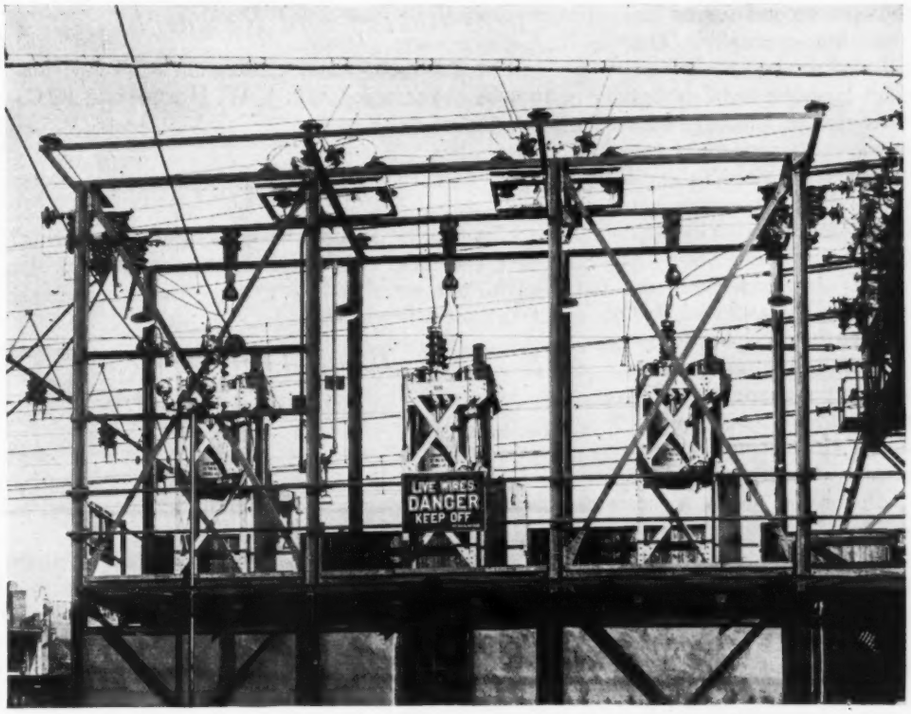
Discussion of the paper brought out the fact that the metallic arc process described is the second successful process developed, the other being the carbon arc welding of the 90-mile pipe line for domestic water supply to the city of Oakland, Calif. Results of the two processes were about comparable, but the speed of the metallic arc process was higher.

It was pointed out that there is much progress still to be made toward reducing total cost in the preparation and handling of the steel plate, since the cost of welding is only approximately 1 per cent of the total.

About 35,000 poles of lodge-pole pine will be produced, treated and used in the Rocky Mountain states during 1928, according to R. W. Lindsay in his paper on the use of this wood for poles. The timber is native in the area and after extensive tests the conclusion was reached that it could compete favorably with other poles. The author stated that open-tank butt-treated poles would last fifteen to twenty years on an average and argued that a pole with low first cost and reasonably long life was best for use by communication companies in the mountain area. Tests at Boulder, Colo., indicated lodge-pole pine had a modulus of rupture of more than 6,200 lb. and treatment methods using seven hours of hot creosote gave a penetration of $\frac{5}{8}$ in. to $2\frac{1}{2}$ in., with an absorption averaging 2.2 gal. of oil per pole. Lines in Colorado have been installed since 1909 and recent inspection showed very satisfactory service results. The author concluded that this timber was a very suitable pole timber for the Rocky Mountain region.

Carrier-current systems for long-distance telephone lines were discussed in a paper by H. A. Affel, C. S. Demarest and C. W. Green. These systems are meeting successfully the requirements of this application, but because the apparatus is complex and expensive it is cheaper to string additional wire for short-distance communication. Systems are now operating for distances of 150 miles and upward. Potentialities are great, however, for simpler carrier systems over short-distance communication. Even on the older systems much work remains to be done in the way of simplification and further use of the high-frequency spectrum. Automatic pilot channel arrangements are being tested to reduce costs and further developments are expected in transposition arrangements to get carrier systems on all pairs of wires.

A high-frequency control system for power systems was described in a paper by L. K. Ludwig. This 500-cycle system consists of a source of power, a means for introducing this power to the transmission lines to be protected by the operation of apparatus, means for getting selectivity in control operations and proper relays to respond to the high-frequency superimposed carrier system. The system used can be applied to a single-phase railway system or to a polyphase power system, but the paper dealt with the details of its use for control of circuit-breaker operations. The principle suggested is to measure the impedance of the power system with 500-cycle current and high-frequency relays, so placed that under abnormal conditions the impedance of a faulty line, as measured by the relays protecting the line in trouble, is sufficiently low to cause circuit breaker operation. The system gives selectivity between parallel lines, is instantaneous, opens simultaneously breakers at both ends of a faulty line, protects the line from short circuits or faults, but will not operate on overloads and measures a fault so that breakers may be reclosed immediately.



High-speed circuit breakers in South Norwalk substation of N. Y., N. H. & H. R.R.

The extinction of an arc was the subject of a paper by J. Slepian. He dealt with fundamental principles as developed through a study of arcs and the application of these principles to oil breakers. He said that the time allowed for extinguishing an arc on a purely inductive circuit and that on actual circuits varies with circuit characteristics. In practical power circuits the frequency of free oscillation may vary from 100,000 cycles per second in the case of a reactor to only a few hundred cycles in the case of a long line. The time for the extinction of an arc varies from 2.5 microseconds to several

thousand microseconds, depending on circuit constants. For this reason the interrupting capacity of a breaker may be affected by the nature of the circuit in which it operates.

The author then discussed ionizing effects during the arc duration and the chemical after effects created in gases by an arc. The rate of recovery of dielectric strength of the arc space is 25×10^6 volts per second during the transition period. The author discussed the use of small holes in metal plates to discharge ions and better the conditions and gave experimental data to support these conclusions. His general conclusions were as follows:

The time interval allowed by the external circuit for the arc space to recover its insulating properties after a current zero is important in the operation of an alternating switch. The low dielectric strength of an ionized gas is to be attributed to the non-uniform potential gradient caused by the development of space charges. Calculations with certain approximations lead to the conclusion that in the case of arcs which are short in comparison with the diameter of their section, the first one or two hundred volts of dielectric strength are recovered almost instantly, while later increments of dielectric strength are recovered at a rate lying between one million and one hundred million volts per second. Experiments have been carried out substantiating this conclusion.

For an arc which is long with respect to the diameter of its section the manner of recovery of its dielectric strength is not so simply stated. It is probably more nearly correct to say that the ability to withstand a certain electric gradient is recovered almost instantly, and that later increments of dielectric strength return more slowly. The magnitude of this gradient varies in an inverse manner with the linear dimensions of the section of the arc as shown by experiments of Mason.

Experiments of Neher and others have shown the possibility of increasing the rate of recovery of dielectric strength by causing the arc to pass through holes in metal plates or the openings in metal gauze sheets.

A continuing chemical activity in the gases from an arc may cause the persistence of low dielectric strength for times long in comparison to those predicted by the preceding theories.

The success of the alternating-current oil circuit breaker is to be attributed to all the factors considered in this paper.

In the discussion of carrier currents for telephone work E. W. Green said that cross-talk between systems could be cared for largely by transposition, but that between channels required careful design of the amplifier used by three channels. Harmonics and frequencies were induced unless the characteristics of the amplifier were carefully determined. Others pointed out the co-ordination of the panel type carrier equipment with other telephone equipment and explained construction details.

In the use of vacuum tubes and high-frequency control of power breakers several discussions were presented. Questions were asked as to the effect of high-frequency surges, steep wave fronts and other disturbances. O. C. Traver pointed out that as the length of line increased the use of the control reactors became objectionable and the cost of condensers would give a high cost of installation.

Several engineers questioned the ability of present equipments to maintain synchronism between the high-frequency sources, and the need for added overload protection as a back-up was accented. But the use of the high-speed vacuum tube was commended and the new system was favorably received as an experimental development with many possibilities. The telephone engineer said the proposed scheme was good under abnormal system conditions, but would add to interference under normal conditions unless very low values of high-frequency current were used.

The paper on arcs brought out good discussion and the author was highly complimented. Brian O'Brian said recent studies of arcs by spectrum analysis largely corroborated the conclusions of Dr. Slepian. R. W. Spurck said that the variations in system constants were so great, and there was no way of getting a value for system constants, therefore the oil breaker must be designed for the worst conditions. He also discussed the use of cooling and pressure to help speed up the revival of dielectric strength. R. W. Sorenson said the voltage across the arc of a 15,000-volt breaker was of the order of 150 to 200, as compared to 10 to 12 volts found under high vacuum conditions, and he pointed out that in some cases the arc goes out before the current reaches zero. He urged reduction in length of arcs in order to simplify breaker operation and reduce duty requirements. C. D. Aylesworth advocated the use of a series of arcs in a breaker in order better to speed up dielectric strength recovery.

Entertainment features of the convention were well arranged with golf, tennis and bridge tournaments, mountain trips and a banquet, with two excellent addresses. Many of those from the East made trips to Pike's Peak, Yellowstone and other points of interest.

PRIZE AWARDS OF THE A.I.E.E.

Engineering Practice

"132,000-volt Single-Conductor Lead-Covered Cable," by P. Torchio, C. H. Shaw, J. B. Noe, L. Emanueli, W. S. Clark, A. H. Kehoe and D. W. Roper.

Theory and Research

"The Production and Utilization of Television Signals," by Frank Gray, J. W. Horton and R. C. Mathes.

Initial Paper

"Movements of Overhead Conductors During Short Circuits," by W. S. Peterson and H. J. McCracken.

Branch Paper

'Calculation of Stray Load Losses," by G. H. Rockwood, Jr.

Time Switches Control Street Lighting

By O. W. Holden
Bureau of Power & Light, Los Angeles, Calif.

When Los Angeles planned to install 5 miles of modern ornamental street lighting on aristocratic Wilshire Boulevard, it became necessary to make more extensive provisions for service than usual. The new system, designed to outshine all existing installations in the city, consists of 393 posts, each containing one 25,000-lumen lamp, which burns from dusk to midnight, and one 6,000-lumen lamp, which burns from midnight to dawn. There are 22 series midnight circuits and six series after-midnight circuits. Twenty-two constant-current transformers, varying in capacities from 20 kw. to 35 kw., are installed in eleven underground vaults. The transformers are of the subway type, the coils being in single-deck construction, permissible because of the generous size of vault opening.

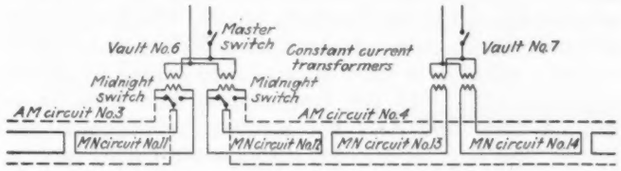


Fig. 1—Typical circuit and switch arrangement for Wilshire Boulevard street lighting

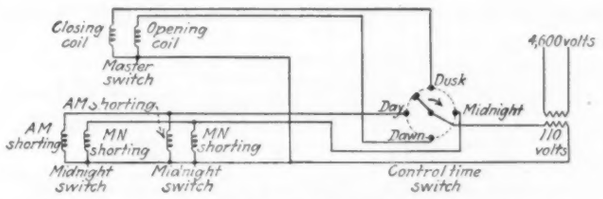


Fig. 2—Time switch and control wiring used for operation of 5 miles of street lighting

The selection of a suitable control system was governed by the following points:

1. The great length of the installation, which traversed territories served from four substations.
2. The requirement of three control operations, "on" at dusk, "off and on" at midnight and "off" at dawn simultaneously at eleven points.
3. The economic desirability of utilizing the same transformers for the after-midnight circuits as for the midnight circuits.
4. The necessity of concealing unsightly equipment.
5. The need of a convenient method of control at times of inspection or testing.

Every commonly used control method was studied. That adopted involved the installation of solenoid oil switches in the vaults, remotely controlled from electrically wound time switches mounted in special posts at the curb. Energy for time switch winding is supplied through 400-volt-ampere watertight potential transformers in the vaults.

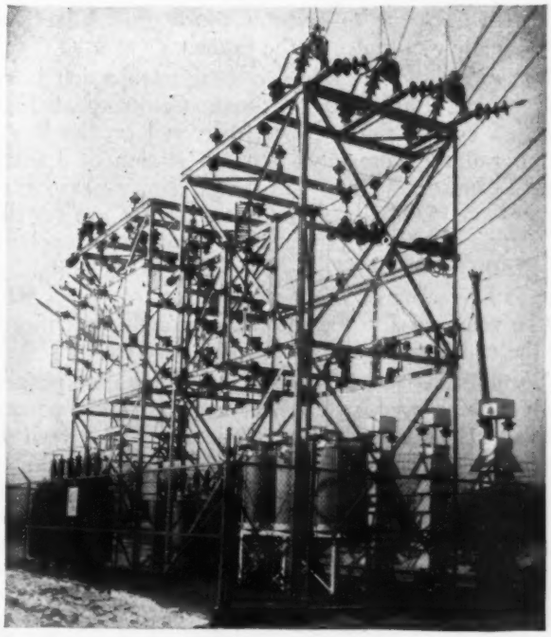
A typical section of the system and the arrangement of switches is shown in Fig. 1. Vault No. 7 contains two transformers serving midnight circuits only. Vault No. 6 contains two transformers, each of which serves a midnight circuit and an after-midnight circuit. In the latter case a master switch closes at dusk and opens at dawn. The midnight switch, or "flop-over," as it is familiarly called, short circuits the midnight circuit and connects the after-midnight circuit to the transformer terminals.

The connections between the time switch and the solenoid switches at a combination midnight and after-midnight vault are shown in Fig. 2. Ten-second contacts are made by the time switch at each of four points, dusk, midnight, dawn and daytime. As each contact is made in succession the proper solenoids are energized, performing the desired operation of the oil switch at the predetermined time. The master switches and midnight switches are of similar design, but each adapted for its particular functions.

It will be noticed in Fig. 1 that in case the midnight operation occurs in vault No. 7 before that in vault No. 6 there is a possibility of a portion of the street being dark during the interim. Therefore, the control switch of vault No. 6 has been set to operate at midnight a few minutes ahead of that in vault No. 7, in order to insure light on the street at all times during the lighting period.

From the standpoint of simultaneous operation, a unit control of the entire system would have been very desirable. However, experience during the short time since operation started indicates that, with close maintenance of the time switches, the "on" and "off" operations of the eleven controls will not vary far from simultaneous, and the overlap at midnight will be reduced to a very short duration. The control system has been designed with provision for readily adapting to carrier current or resonant control in the future.

Unit Type Substation



Service to small communities from transmission systems presents certain readily apparent opportunities for economical practice. One of these is in the use of unit type substations that may be quickly expanded to take care of additional load as it comes on. The one shown here, on the lines of the Central States Electric Company at Armstrong, Iowa, is a good example. It is to be noted that the two units, the second added some years after the first was installed, are practically identical in construction.

Facilities for Railroad Service*

Requirements governing arrangement of equipment and features of latest Pennsylvania electrification

By R. B. Morton
Project Engineer Gibbs & Hill

THERE are at least four rather distinct methods of arranging the switching equipment for railroad substations:

1. Switching under load the transmission circuits, high and low sides of transformers and trolley feeders, as in the case of the original Paoli-Chestnut Hill electrification of the Pennsylvania Railroad.

2. Switching the high-tension side only for controlling both transmission and trolley circuits, as in the case of the Virginian Railway.

3. Switching under load the transmission and trolley feeder circuits, but not the transformers, as in the cases of the original electrification of the Elkhorn grade on the Norfolk & Western Railway and the New York Connecting-Long Island Railroads.

4. Switching under load on the low-tension side only, for controlling both high-tension and low-tension circuits, the transformers being switched and regarded as a part of the transmission system, as in the case of the recent Pennsylvania Railroad suburban and through electrification.

The electrification of the Maryland division of the Pennsylvania Railroad from Philadelphia to Wilmington, Del., a distance of about 27 miles, and of the Wawa branch to West Chester, a distance of about 26 miles, is now nearing completion. Approximately 105 miles of electrified track are involved in the main line work and approximately 50 miles in the branch.

Power Supply.—Power for the electrification is supplied by the Philadelphia Electric Company at 13,200 volts, 25 cycles, single phase, delivered on the busbars of the railroad company's step-up station at Lamokin Street, Chester. Three self-cooled single-phase transformers of 15,000 kva. continuous rating are provided for stepping up this power to a transmission potential of 132,000 volts. This transmission potential was selected by reason of the large amounts of power which will be required for the ultimate through electrification and the considerable distances to be covered.

Substations.—A total of nine substations are provided in which the power is stepped down to a trolley potential of about 11,000 volts. The average interval between substations is 6.4 miles and most of them contain two 4,500-kva. transformers. It is planned that the number of step-down transformers in each of the substations serving the main line may ultimately be increased to four.

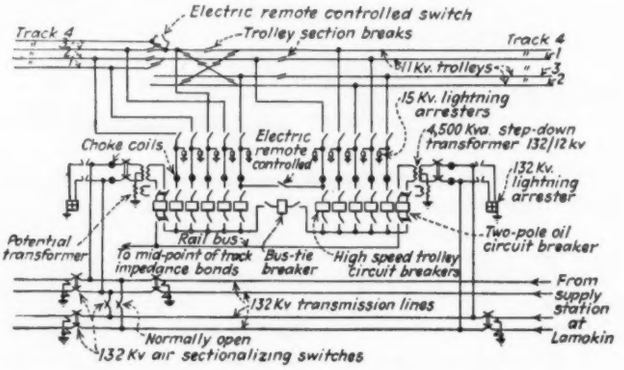
The transformers are self-cooling and are capable of carrying continuous rated load, followed by 150 per cent of rated load for two hours, followed by 300 per cent of rated load for five minutes.

A feature of these substations, as well as of the step-up substation, is the absence of oil circuit breakers in the high-tension side.

In the step-up substation oil circuit breakers are provided in the low-tension side of the transformers, giving automatic protection in the event of transmission line fault. The transformers are connected on the high tension side to outgoing transmission lines through two-pole, 132-kv. air sectionalizing switches, remote electrically controlled, which are not to be opened under load, but are capable of interrupting transformer exciting current.

In a similar manner the transformers in each of the step-down substations are connected to the high-tension lines through air sectionalizing switches, and the low-tension side of each is connected to trolley and rail buses through a two-pole oil circuit breaker, arranged for automatic tripping on reverse power, on unbalanced voltage on the high-tension side, or by differential protection against failure on the trolley bus or within the transformer. A fault on any part of a 132-kv. transmission circuit will trip out of service one transformer in the step-up station and one transformer in each step-down station which is served by the transmission line on which the fault occurs. Such an outage does not affect train operation, as sufficient transformer capacity remains in each substation to handle maximum expected loads. If the transmission line fault is to ground only, and does not involve the opposite conductor, the flow of current through the earth, back to the step-up station is limited to about 200 amp. by a neutral resistance connected to the mid-point of each step-up transformer.

Trolleys are sectionalized at each substation and each trolley section is normally fed from each end, thereby



No circuit breakers used on high-tension side of transformers

avoiding "stub-end feed." Trolley circuit breakers are designed to open under short circuit within an interval of time not exceeding $\frac{1}{15}$ second. The rupturing capacity of these circuit breakers is 50,000 amp. This high value of rupturing capacity was required with a view to ultimate conditions as to transformer capacity at step-up and step-down substations. This installation represents the first use on any extensive scale of quick opening circuit breakers in alternating-current railway electrification, and it is expected that inductive disturbances and damage to overhead wires and insulators resulting from trolley short circuits will be minimized by the quick-acting feature.

Substations are unattended, and are controlled from a panel containing control switches and indicating lamps placed in signal interlocking towers or other points continuously attended. Certain substations on the West Chester branch are so remote from a continuously attended tower that it was necessary to provide supervisory control for these substations, utilizing wire circuits in an aërial communication cable along the right-of-way.

**Excerpts from paper presented before A.I.E.E. at Denver, June 25-29.*

Financing Through Rights

Many utilities build up permanent markets for their securities by selling shareholders additional stocks at a price frequently below the market

THE issue to shareholders of rights to subscribe to additional stock at a rate sometimes below the current market price has been widely adopted in the financing policies of public utility companies. Last year power and light companies alone secured close to $200,000,000 in this way. During the current year to April 30 more than $80,000,000 in rights has been offered to shareholders. This is 13 per cent of all capital raised during the period, and the issue of rights as a specific type of financing is consequently assuming some significance.

Among the issues of rights offered by power and light companies to their shareholders this year to date are those shown in the accompanying table. The first of these issues is more or less typical of current practice in the power and light industry. Common stock holders of the Pacific Gas & Electric Company of record of April 17 were given the right to subscribe on or before March 23 for additional common stock at par of $25 on the basis of one new share for each ten shares held. Provision was made, as is customary, for payment by installment so that the sudden announcement of the issue of rights would not find the shareholder unable to take up that quantity of the new stock to which he was entitled by virtue of his existing holdings.

Utility executives differ with regard to the relative merits of paying stock dividends and issuing rights. Both policies are currently in wide use by power and light companies. Both combine the functions of raising new capital and at the same time remunerating shareholders.

In our issue of March 17 the stock dividend policy was discussed by Frank Dame of the North American Company. Some aspects of the policy of issuing rights are here presented.

The second issue is a modification of the simpler type represented by the first example. The Public Service Corporation of New Jersey offered $43,689,000 in twenty-year, 4½ per cent debentures to holders of common and 8 per cent preferred stocks. Holders of each 50 shares of such stock were given the right to subscribe for $500 of debentures at $98 and interest and these debentures in turn are convertible into common stock. This issue was wholly underwritten by the corporation's bankers, a policy which is usually followed.

Many other large power groups have consistently followed the policy of issuing rights to their shareholders year after year. Detroit Edison, for example, offered 25 per cent stock rights in 1923, 25 per cent in 1924, 10 per cent in 1925, 10 per cent in 1926, etc. Commonwealth Edison offered 20 per cent stock rights in 1923, 20 per cent in 1924, 12½ per cent in 1925, etc.

The issue of rights is a convenient and economical method of raising capital, and at the same time the policy rewards the shareholder for his support of the company in advancing his capital for its use. The policy tends to build up a permanent market for capital and the cost of financing is relatively low. Not only does the shareholder provide capital by the exercise of his rights but he spasmodically invests additional capital. In the case of the Commonwealth Edison issue cited above it was pointed out by Mr. Dame in the issue of March 17 that the stockholder's original $100 interest in the company is increased to $120 in 1923, to $144 in 1924, to $162 in 1925 and to $182.25 in 1926. In exercising his rights the shareholder subscribes for $82.25 worth of additional stock. During the period he had received 8 per cent cash dividends, $32 on his original stock and $13.37 on the new, or a total of $45.37. In this way, in using his rights to buy $82.25 additional stock at par, he had to pay $36.68 in addition to reinvesting the $45 received in cash dividends. This is urged by advocates of the stock dividend as an objection to the policy of issuing rights, but it is evident that in this way new capital is constantly being brought into the enterprise.

RIGHTS OFFERED JAN. 1-APRIL 30, 1928

	Amount Offered
Pacific Gas & Electric	$657,750
Public Service Corporation of New Jersey	43,689,000
American Super Power	13,200,000
Cities Service Company	19,395,000
Electric Bond & Share Securities	4,807,656

Experience of Southern California Edison

The experience of the Southern California Edison Company in this connection is of unusual interest. In addition to its large annual operating charges this organization is spending between $30,000,000 and $40,000,000 annually for new hydro and steam plants and pertinent transmission lines, etc., to take care of the enormous electrical growth in southern and central California. Its financial framework had to be designed to permit of obtaining such capital at as low a rate as possible. This, according to an official of the company, necessitated offering different classes of securities to appeal to different classes of investors under varying conditions of the money market, etc.

While the major part of Southern California Edison's financing is being carried out through the sale of bonds and preferred stock to maintain a proper balance, the company offers each year to its common stock holders rights to subscribe to additional common stock on an

attractive basis; this year, for example, the company's budget is approximately $32,000,000. Of this amount about $5,500,000 will be raised through an offering of common stock to existing stockholders in the ratio of one new share at $25 for each ten shares owned as of March 30. As the market for Southern California Edison common is approximately $50 at the time of writing, this right constitutes a valuable privilege. According to a statement made to the ELECTRICAL WORLD by an official of the company the practice of issuing rights has always met with complete success and the entire issue has always been taken up for cash. It is of interest that the company has found it very beneficial to combine the issue of rights with sale of stock to the customers. The cumulative effect of this policy during the past ten years has been manifested in facilitating the sale and distribution of these securities, especially during the past year or two. At the close of 1927 there were 114,450 individual shareholders whose holdings average 50.3 shares at $25 par each. This indicates the broad distribution of stock ownership which the company has built up over a period of years.

When a company follows a policy of issuing common stock year after year in the form of rights, the maintenance of a proper balance in capital structure, as already intimated, must be kept in mind. The Southern California Edison Company secures funds for construction and other purposes to the extent of approximately 50 per cent in bonds, 30 per cent in preferred stock and 20 per cent in common stock. Through the policy outlined, in which the issue of rights plays an important part, the company apparently has been able to finance its operations on a quite low cost basis. One of the officials made the statement that the cost of selling securities according to the policy adopted has been about 60 per cent cheaper than the cost would have been for other modes of financing, taking the average for the past ten years. In respect to the execution of their rights by the shareholders of the Southern California Edison Company an official states:

"We have never found it a detriment in selling for the stockholders to pay cash outright for their purchases, although there are many cases where stockholders, for various reasons, prefer to sell their rights and count the proceeds as an extra dividend, instead of taking up their allotment of new stock.

"Should the company, at any time, find a demand from stockholders that they be permitted to take up their stock on an installment plan, such plan could easily be arranged. In the case of employees who are entitled to subscribe for new issues of common the company has a plan whereby their allotments may be paid for in ten equal monthly payroll deductions."

MARKET ASPECT OF RIGHTS

Usually a market is created for rights, and the certificate representing them may be traded separately from the stock itself during the period between the time when the rights first accrue to the stockholder and the date of expiration. In such cases there is usually keen market interest in the issues, with the possibility of arbitraging between the two. The market value of a right can be arrived at conveniently by the following computation, which is not based on mathematical accuracy so much as on experience:

"Divide the difference between the market price of old stock and the purchase price of the new by the number of shares to be held for each new one received, plus one." As an instance, rights were recently issued one for four at $50 by one of the power companies. When the stock of the company sold at $90 the rights were worth around $8, thus:

Price of old stock	$90
Purchase price of new	50
	$40

Divide 40 by 5 (number received for each one held, plus 1).

Obviously, apart from the differences outlined, the stock dividend and the rights policies differ only in working details. In the first case stock is paid directly to the shareholder and he is at liberty to market his new shares for cash if he so desires. In the second case he receives his regular dividend in cash and the option of subscribing to new stock at a preferential rate, or of cashing in this subscription privilege. Each policy has its merits from the company's standpoint and each has its advocates among the investing public.

Radio Interference Complaints and Investigation Costs

BY J. B. PRINCE
Sioux City Gas & Electric Company, Sioux City, Iowa

THE accompanying tabulations present an analysis of the causes of radio interferences reported to the Sioux City Gas & Electric Company, together with the costs of investigating. The period covered is from April 1, 1921, to Feb. 1, 1928. From these tabulations it is seen that the electric utility is responsible for only 22 out of a total of 118 interferences, or less than 19 per cent. This proportion is about the same as is found in other localities. The cost figures, which include labor, supplies and transportation in investigations, are assigned to the sources in the table in proportion to the number of their complaint responsibilities. The costs of remedying interferences are not included, since they are charged to the sources of interference.

TABLE I—SOURCES AND COSTS OF COMPLAINTS

Sources	Number	Cost of Investigation
Sioux City Gas & Electric Company	22	$86.02
Sioux City Service Company (Street Railway)	14	54.74
Total—utilities	36	140.76
Other sources	82	321.05
Total—all sources	118	$461.81
Average per call		3.91

TABLE II—CAUSES OF INTERFERENCE

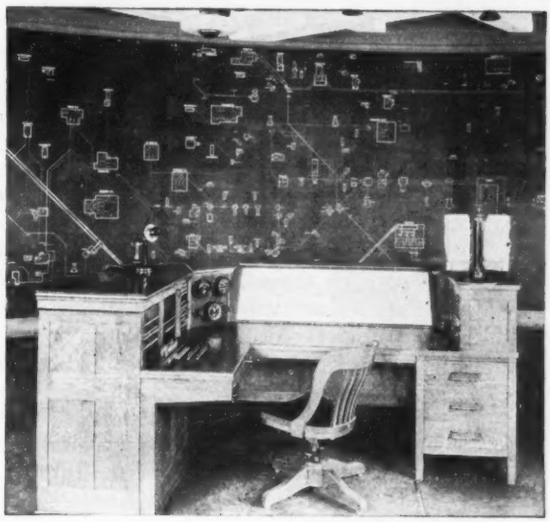
Cause	No.	Per Cent of Total
Defective house wiring	4	3.39
Voltage complaints (warranted)	9	7.62
Voltage complaints (unwarranted)	12	10.17
Static	1	.85
Fading	1	.85
Heating pads	3	2.54
Battery chargers, vibrating type	9	7.62
Motor commutators	2	1.69
Electric incubators	2	1.69
Receiver or eliminator	28	23.94
*Arc on primary	3	2.54
*Arc on street-lighting circuit	2	1.69
Hum from street-lighting circuit	2	1.69
33-kv. lines	6	5.08
Street cars	14	11.86
Interference not apparent during call. No later complaints	20	16.95
Total	118	100

*Most difficult to locate.

Operating Desk that Facilitates Load Dispatching

By B. N. Merritt
Assistant Load Dispatcher Pacific Gas & Electric Company, Oakland, Calif.

OPERATING desks now in use in the dispatcher's office of the Pacific Gas & Electric Company were constructed in 1924 by a local cabinet maker, it having been found impossible to purchase a suitable desk for adaptation. The type of desk used is a development of an idea which has been in use by this organization for many years, embodying telephone equipment, operating maps, stationery cabinet, typewriter compartment and ample working space. As shown in the illustration, the dispatcher has his entire equipment within reach at all times.



Load dispatcher's desk provided with motor-driven operating map

The two operating desks are exact duplicates and all electrical and telephone connections are so made that either dispatcher can attend to any call or operating problem. The telephone equipment contained in the specially constructed exchange boards at the left end of the desks is the property of the telephone company and on these boards terminate the telephone circuits leased by the company for its private use. The cordless telephone boards adjacent to the exchange boards carry the telephone lines owned and operated by the Pacific Gas & Electric Company. The instrument panel is so connected as to provide the dispatchers with constant indication of voltage and frequency on the main sources of power supply to the Bay cities.

The most unusual feature of the desks is the motor-driven roller map mounted in each. The map-rolling mechanism is entirely separate and sound-insulated from the desk proper and is easily removable for correction and renewal of maps. Each is capable of handling about 100 ft. of continuous roll, allowing for considerable growth beyond present requirements. On these rolls are blue-line prints of operating diagrams, telephone maps, relay charts, water system maps and other information essential to efficient dispatching, to any part of which the dispatcher may almost instantly refer by operating a pull-button switch. This system of map and diagram mounting has proved extremely satisfactory and valuable, as it brings all necessary information to hand at once without confusion and at minimum interference with working space.

As it is the practice in this office to type all record cards, daily operation logs, etc., the typewriter cabinet and shelf is also a necessary adjunct. Noiseless typewriters are used and all telephone messages, orders, etc., are transferred directly to continuous folded strip paper, perforated for separation into standard letter-size sheets for filling.

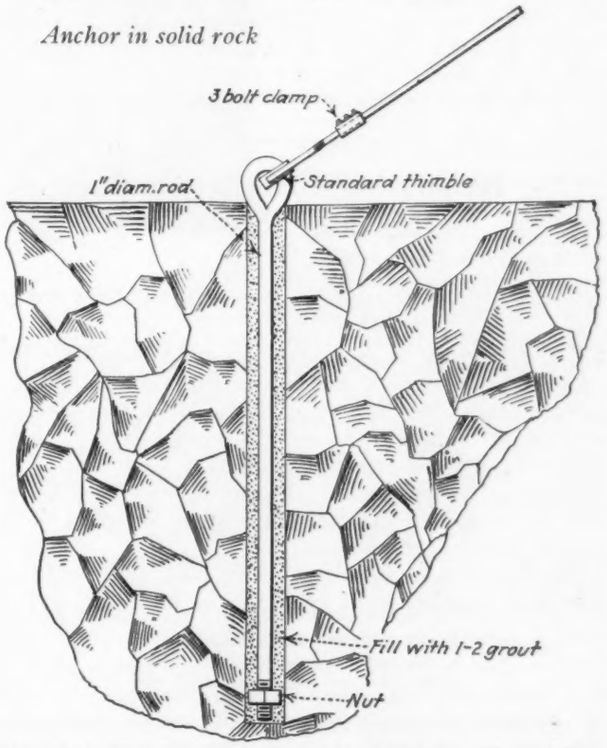
Both the left end and the rear of the operating desks are made up of removable panels, so that easy access may be had to all wiring and mechanism inside. In addition, the top sections of both the telephone exchange boards and the compartments housing the private telephone equipment and meter accessories are hinged to increase their accessibility.

The dispatcher's room is equipped with a special sound-proof ceiling, constructed of asbestos and felt on a wooden falsework, which eliminates echo and deadens all external noise, resulting in a very material reduction of interference between the two desks, as well as disturbance due to street noises, etc. This sound-deadening has greatly increased the efficiency of the dispatching force and noticeably reduced the nerve strain attendant upon work of this character.

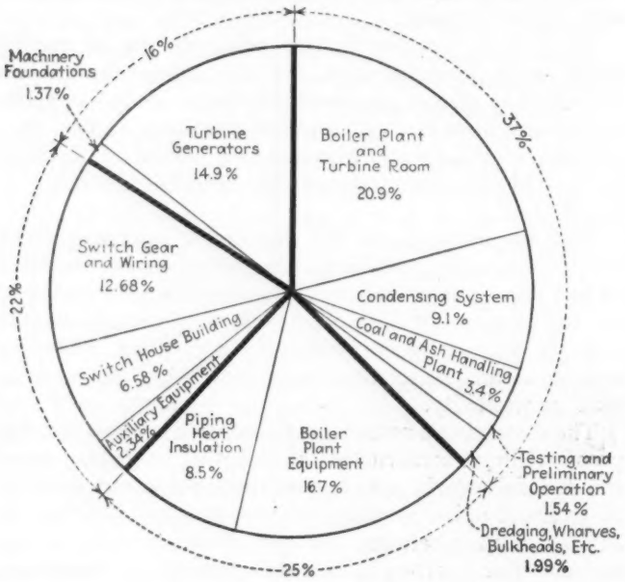
Rock Anchor

THE method shown in the accompanying sketch is in use on the system of the Kansas City Power & Light Company for making anchorages in solid rock. A 1-in. rod, threaded at one end and 30 in. long under the eye, is used. A hole $2\frac{1}{2}$ in. in diameter and 30 in. deep is drilled in the rock and the rod with a $1\frac{3}{8}$-in. square nut on the end is placed in the center. The hole is then filled with a 1:2 cement and sand grout which is tamped solidly.

Anchor in solid rock



Proportional Investment Costs of Edgar Station



THROUGH the courtesy of Irving E. Moultrop, chief engineer of the Edison Electric Illuminating Company of Boston, the accompanying circle diagram is made available showing the relative investment costs of the major portions of the Edgar station at Weymouth, based on 70,000-kw. development and excluding investment in land and other outlay which has been made at this time, but which will serve the ultimate station.

This station contains turbo units operating at 1,200 and 350 lb. steam pressure. Mr. Moultrop states that one of the most important points which has been demonstrated at Edgar station is that the cost per unit of capacity is about the same for a plant properly designed for 1,200 lb. as for 350-lb.

Relamping Present Sockets Increases Revenue

By M. Luckiesh
Director Lighting Research Laboratory, National Lamp Works, Nela Park, Cleveland

THE average home today has only about one-half as many sockets as are needed for adequate and convenient utilitarian lighting. Furthermore, the average wattage per lamp in these sockets is only about 40 watts, which from a conservative utilitarian viewpoint is not adequate. A step toward adequate lighting in the home may be made by increasing the wattage in many of the sockets in the average home.

Of the lamps now existing in the utilitarian sockets of the home (exclusive of closets, attic and exterior)

29 per cent are smaller than 40-watt
52 per cent are smaller than 50-watt
80 per cent are smaller than 60-watt

The average annual gross revenue to the central station due to replacing these smaller sizes in each case would be

9 per cent if 40-watt lamps were used
19 per cent if 50-watt lamps were used
34 per cent if 60-watt lamps were used

The possible sale of lamps due to replacing these smaller sizes would be

120,000,000 if 40-watt lamps were used
210,000,000 if 50-watt lamps were used
315,000,000 if 60-watt lamps were used

In the case of replacing all lamps in utilitarian sockets smaller than 50-watt with 50-watt lamps, the average annual gross revenue per residential customer, provided the degree of activity of these sockets remains unchanged, would be increased from $27.89 to $33.47. The number of 50-watt lamps sold, if such a campaign were completed 100 per cent, would be equivalent to nearly twice the present annual sale of all sizes of lamps for renewal in the 17,600,000 wired homes in this country.

Roasting Cereals with Electric Heat

By George W. Bernhard
Industrial Heating Engineer Great Western Power Company, San Francisco, Calif.

UNIFORM heat and a cleaner and better finished product are some of the advantages claimed for electric heating of four cereal roasters in the Oakland, Calif., plant of Albers Brothers Milling Company. The machines consist of revolving cylinders, geared and belted to a line-shaft.

The heating equipment, designed by the Wessix Electric Heating Company of San Francisco, consists of ten 2-kw. strip heaters for each machine. The heaters are evenly distributed around the outer surface of the cylinder and riveted securely. Two-heat control is provided and connections to the 220-volt feeder are made through specially designed collector rings mounted on one end of the shaft. Heat insulating is held in place by a galvanized iron shell.

Approximately 200 lb. of wheat is loaded into each of

Better product obtained with electric heat by Albers Brothers Milling Company

the roasters. After revolving for about two minutes the full 20 kw. is applied for ten minutes, when it is reduced to 10 kw. and the roaster revolved slowly, resulting in a slow cooking or roasting process. Each batch requires one hour and twenty minutes, the time not varying more than one or two minutes.

The finished product, "Barnes Toasted Wheat," has a uniform color, is free from burning or scale and the operator has no trouble with the heat regulation during the roasting process. The fire hazard is reduced and a much cleaner and more efficient operating room is maintained. An order has been placed for four more electrically heated roasters.

Where the Jobber Stands

A statement by the leader of the jobbing industry in an address before the recent convention of the National Electrical Wholesalers' Association

By GEORGE E. CULLINAN

Vice-President Graybar Electric Company
Chairman National Electrical Wholesalers' Association

BUSINESS has come to the conclusion that for years the jobber has simply gone along, taking life easy and profits easily. But I cannot recall a time in my twenty-five years in the electrical supply jobbing business when the jobber has not been ringed around with problems. If there has ever been a time when the jobber was the "fair-haired boy of business," it was long before I had any contact with him. But I can say that never before has the jobber had so much printed about him and so much said to him—and the publicity has had its effect. Recently, hands that mean to be helpful have been slapping us on the backs in what were meant to be taps of encouragement, but taps that have left us smarting under the impact. We have been told that we are "sick and worried."

George E. Cullinan

That we are sick, we dispute; that we are worried, we don't deny. An industry that is sick does not attract big business and big capital. The electrical supply jobbing field has seen big business and big capital enter it in recent years, to find a place in what it must consider a vital as well as lucrative part of the electrical industry.

When we think of a business as being sick, we have in mind a business pierced through and through with failures—a business with more liabilities than assets. The electrical supply jobbing industry has been surprisingly free of failures in the past year—very few financial failures and fewer failures to do the job for which the jobber has been established.

Our assets remain intact; they are the ability to distribute merchandise from manufacturer to user cheaper and better than it can be distributed by any other agency. Our liabilities are changing conditions and changing viewpoints and possibly a lack of vision on our own parts to appreciate the strength and importance of our position. We do, indeed, dispute the allegation of sickness and, on the other hand, stand ready to prove in a financially sound and mentally alert membership every indication of a vigorously alive business ready to cope with the problems we admittedly face.

The problems that we face and the worry that they occasion are caused by rapidly changing conditions in all business in general and the electrical industry in particular. Let me cite briefly a few of these changed and changing conditions and their effect:

Not so many years ago we enjoyed an appreciable business with the independent telephone companies of this country. Today that business has virtually faded out due to the acquisition of a large number of these companies by the Bell System. This represents a perfect example of the effects of a changing business cycle on an established industry.

Then, too, the recent accelerated movement toward mergers in the power industry has so changed the buying habits of these companies that business of many electrical supply jobbers previously serving them has been very markedly changed. Despite these mergers, however, there is a distinct service we jobbers can perform for the central stations. Experience and education alone will serve to prove this point, so that I feel that present changes in buying habits on the part of the power companies are but temporary.

The tremendous facilities for manufacturing various products, brought about by war activities, were virtually at a standstill when the demand originally brought upon them by the war ceased upon its conclusion. Many manufacturers with tremendous excess production facilities on their hands looked around for new products to make, and many of them, looking at the electrical industry, which represented a comparatively new and seemingly fertile field, developed into electrical manufacturers.

Then, too, those manufacturers who were and had been for years engaged in the manufacture of electrical devices

increased their production facilities during the war to take care of the increased business they secured during that hectic period. When the war demands ceased a great number of large orders ceased with them, with the result that many electrical manufacturers also found themselves with excess production facilities.

Disturbing Conditions

The net of all this is simply that for a number of years the production of electrical supplies has been greatly in excess of the demand. Many manufacturers, finding themselves with large production facilities and extremely anxious to keep their factories busy, blamed the jobber because swollen production facilities were not kept employed and became dissatisfied with their time-proved jobber system of distribution. In many cases the manufacturer accused the jobber of not doing a real sales job and felt that the solution to all his problems lay in his selling direct. The buyer, on the other hand, found himself in an almost perfect buyers' market. Excess production on the things he bought and a tendency to shave prices on the part of distributing outlets who had been harassed by manufacturers to get volume, and a fulfilled threat on the part of many manufacturers to sell direct, had depressed prices and put the buyer where he has been able virtually to dictate his own terms at the expense of the jobber.

It is a known fact that the jobber has always been called upon to pioneer new lines and new markets. In the early days of the electrical business, electrical appliances, from the iron to the washing machine, were decided novelties. It was the electrical jobber who took these appliances and sold them to his dealers and through his dealers to the public.

In comparatively recent years manufacturers of electrical appliances with volume production have developed high-pressure selling and merchandising methods, and in that development have pushed the jobber completely out of the picture, because it can be stated, as a definite proposition, that it is virtually impossible for a jobber to function satisfactorily and profitably as a high-pressure merchandiser using his standard distributing facilities.

As the structure of high-pressure selling and merchandising breaks down and electrical appliances, which are more in the nature of specialties, become staples, these appliances will again find their way back to the jobbers as the most economical method of distribution.

The electric iron and fan are typical examples of what were once specialties but which are now staples, the total distribution of which is handled without question through jobbing channels. The electric vacuum cleaner is rapidly approaching this stage, and I venture the opinion that in the very near future the great bulk of vacuum cleaners will again be sold through jobber distribution.

The same thing holds true of washers and ironers and other appliances. So that while it is true at this time that the electrical supply jobber virtually finds himself out of the appliance business, the time is coming, and coming rapidly, when most electrical appliances will again be distributed through the electrical jobber.

We are fortunate in being a part of a young, growing industry. As one product passes out there are new ones being developed to take its place. Radio is a typical example of new developments that come along rapidly in this industry of ours that find their chief channel of distribution through electrical jobbers, whose volume more than makes up the loss in other directions.

The things that I have mentioned are those that bulk large when any review is made of the present situation that the electrical supply jobber finds himself in. But a further careful review will reveal many other points that are of interest and have an important bearing on the supply jobber's problems.

A current misconception of the jobber's functions is the belief that the jobber simply buys goods at a given price and sells them at a higher price. This is not true! The two main functions of the jobber as he is now constituted are, first, he acts as a sales and distributing outlet for the manufacturer and his products, and, second, he acts as a warehouseman for the manufacturer and for the buyer. One of the points of friction between the manufacturer and the jobber today lies in the misunderstanding on the part of the manufacturer regarding these important and fundamental functions of the jobber.

Another misconception of the jobber and his functions swings in the opposite direction. Many manufacturers are unsatisfied and discontented with their present jobbing outlets because the claim is made that their jobbers do not do a promotional job on their lines. The reason that the average jobber does not do a promotional job on many manufacturers' lines is that he can't, on his present jobbing compensation, and live. As a matter of fact, the average jobber could not live on his present compensation on a pure jobbing set-up were it not for the fact that he has learned to do business on an efficient and economic basis that it might profit many manufacturers to follow. He has mastered, for the most part, the problem of stock maintenance and turnover and is handling his business on an expense rate so low that it is possible for him to function on his low gross and still show some net.

Cost and Market Analysis

While we have gone a long way, as I have indicated, in keeping down our expenses, in increasing our turnover and finding ways and means to show a net at the end of the year, there still remain many things to be done. Two of the most important things are, first, to analyze our expenses more closely, and, second, to study our territory more closely.

An analysis of our expenses will frequently point a way to further economies. The question of the close study of territory is an exceedingly important one. Urged on, as most of us have been, by the manufacturer to get more and more volume, we have scattered our fire in many instances and covered so much territory that the added business we have secured has not represented net gain, but rather net loss. I am sure were you to study the businesses of those jobbers who have lost money in the last year, you would find that their losses very frequently have been caused by the expansion of territory and sales effort, which expansion has gained gross business but no net profit.

The business of distribution is an important one. Call it what you may or perform it as you will, it will always be a very vital cog in the American business machine. As long as certain elements are present in our business, so long will we have problems. So long as we have overproduction and anti-jobber agitation, so long will we have a desire on the part of the manufacturer to sell and the consumer to buy direct. The real answer to our problems will come when the manufacturer and consumer alike find, through bitter and costly experience, that the best and cheapest method of distributing and buying electrical merchandise is along the straight line from manufacturer to jobber to consumer.

Street Lighting Expenditures by 42 Cities Compared

By Otto P. Ortlieb
Street Lighting Division, City of Trenton, N. J.

BY MEANS of replies to a questionnaire sent to 42 cities throughout the country and ranging from 100,000 to 200,000 in population, the accompanying figures have been compiled. The total cost of the street lighting for 1927 was requested. This was to include the charges of the operating company and also the administrative costs, such as salaries, office supplies, etc., in the street lighting division. In addition, the 1922 cost and the future increase planned were requested on the submitted information blank.

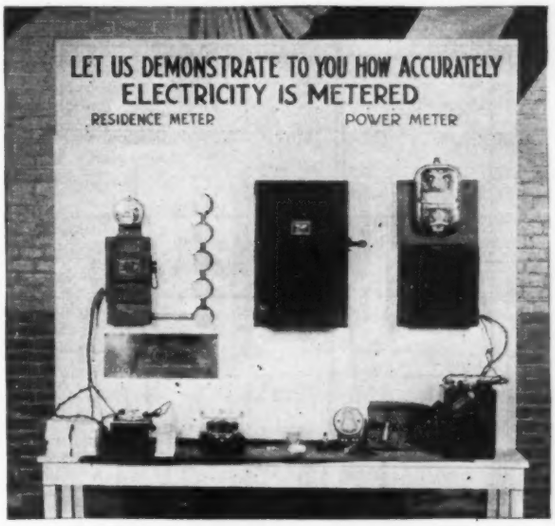
The cities have been arranged in the order of their costs per capita per annum, as shown in the first column. The average annual percentage change is assumed to have occurred each year, so that where the increase is given as 10 per cent this means an increase of 10 per cent each year over the preceding year. Most of these changes were increases, the decreases being marked by a minus sign. The greatest increase was 17.0 per cent in San Diego, Calif., over a period of four years, and the largest decrease was 3.5 per cent in Fort Worth, Tex., over a period of three years. For the 39 cities which supplied this data the average annual change in the per capita per annum cost for approximately the past five years was an increase of 4.7 per cent.

A general indication of the future changes planned by these cities has been made. Large increases are planned by three; moderate ones by twenty-three; small increases by thirteen; one is planning no change, and one is planning a slight decrease.

Since the questionnaire was brief and did not attempt to go into any detail, there are probably some irregularities in the various reports. In some cities part of the street lighting cost is borne directly by the abutting property owners and would not be included in a report of the cost to the city. In some cities where there are municipal plants the reports might possibly not include all depreciation and interest charges. In a few cases the fiscal year does not end with the calendar year and the 1927 cost cannot be accurately determined. The figures shown are considered reliable as they were obtained directly from each city, but, on the whole, the actual costs may be slightly higher than indicated.

Demonstrates Accuracy of Meters to Public

AN EFFECTIVE meter display featuring accuracy of energy measurement in residential service and power applications was prepared by the Fitchburg (Mass.) Gas & Electric Light Company for an electric show. Each type of meter was mounted on a panel with connections to a portable standard, a lamp bank and motor being wired to the outfit to enable readings in each class of service to be checked. Meter parts were also displayed in knockdown arrangement.



Panel-mounted meters serve in accuracy demonstration work

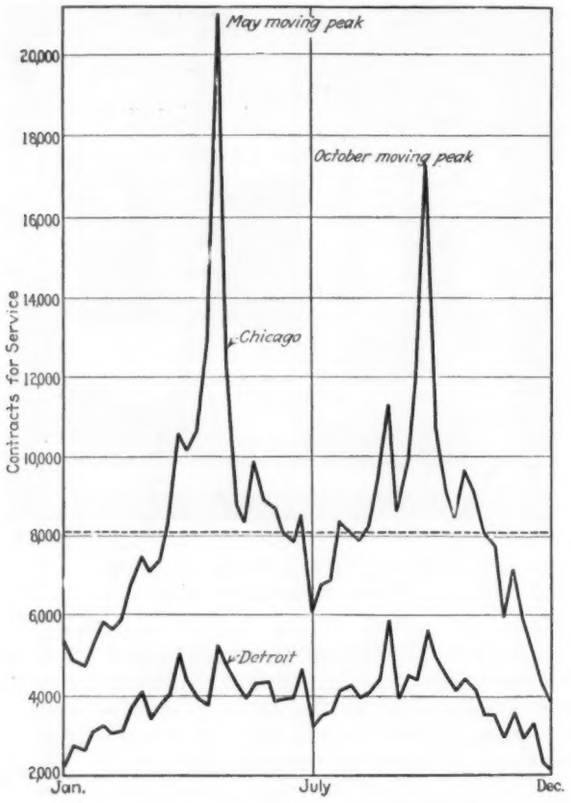
1927 Street Lighting Costs

	1927 Cost per Capita per Annum	Estimated 1927 Population	Total 1927 Cost	1922 to 1927 Average Annual Increase in Cost per Capita per Annum, Per Cent	Future Increase Planned
1 Yonkers, N. Y.	$2.089	115,600*	$241,451	4.5	Large
2 Albany, N. Y.	1.730	125,300*	216,710	5.8	Moderate
3 San Diego, Calif.	1.727	115,300	199,071	17.0 (4)†	Moderate
4 Des Moines, Iowa	1.578	148,900	235,000	1.7	Moderate
5 Trenton, N. J.	1.548	136,700	211,600	13.4	Moderate
6 Lowell, Mass.	1.541	110,296*	170,000	5.3	Small
7 Springfield, Mass.	1.462	147,400	215,553	....	Moderate
8 Worcester, Mass.	1.449	195,500	283,248	3.5	Moderate
9 Utica, N. Y.	1.402	103,400	145,000	10.5 (4)†	Moderate
10 Syracuse, N. Y.	1.349	197,000	265,733	10.0	Moderate
11 Lynn, Mass.	1.243	104,800	130,310	11.2	Moderate
12 Memphis, Tenn.	1.161	178,900	207,578	4.6	Moderate
13 Camden, N. J.	1.062	133,100	141,375	2.9	Moderate
14 Fall River, Mass.	1.027	132,600	136,154	0.1	Small
15 Cambridge, Mass.	1.026	123,900	127,163	5.2	Moderate
16 Erie, Pa.	.986	141,000*	139,082	3.6	Small
17 Kansas City, Kan.	.981	117,600	115,411	8.7	Decrease
18 New Bedford, Mass.	.922	127,500*	117,511	— 0.9	Small
19 Elizabeth, N. J.	.915	120,000*	109,762	0.0	Moderate
20 Salt Lake City, Utah	.908	135,700	123,173	4.8	Small
21 Grand Rapids, Mich.	.905	161,900	146,556	8.0	Small
22 Youngstown, Ohio	$0.875	169,400	$148,141	13.6 (2)†	Moderate
23 Nashville, Tenn.	.871	137,800	120,000	— 2.7	Moderate
24 Bridgeport, Conn.	.859	160,000*	137,500	1.2	Small
25 New Haven, Conn.	.836	184,900	154,587	0.8	Moderate
26 Richmond, Va.	.824	191,800	158,067	8.7	Moderate
27 Waterbury, Conn.	.820	100,000*	82,000	2.1	Moderate
28 Scranton, Pa.	.797	143,900	114,696	11.6	.....
29 Paterson, N. J.	.793	143,800	114,000	2.9	Large
30 Wilmington, Del.	.782	126,400	98,831	2.5	Moderate
31 Hartford, Conn.	.772	168,300	130,000	— 0.6	Moderate
32 Reading, Pa.	.770	114,500	88,222	....	Moderate
33 Dayton, Ohio	.740	180,700	133,800	2.7	Small
34 Tacoma, Wash.	.709	107,200	76,000	1.8	No change
35 Spokane, Wash.	.707	109,000	77,029	2.5 (6)†	Small
36 Fort Worth, Texas	.669	163,600	109,472	— 3.5 (3)	Small
37 El Paso, Texas	.582	113,500	66,078	5.0	Small
38 Flint, Mich.	.547	137,564*	75,206	5.8	Moderate
39 Norfolk, Va.	.547	179,200	98,041	1.0 (2)†	Small
40 Duluth, Minn.	.545	114,700	62,556	2.9 (6)†	Large
41 Oklahoma City, Okla.	.480	145,800*	70,000	....	Moderate
42 Tulsa, Okla.	.467	150,000	70,000	5.7 (4)†	Small

Average 42 cities—Cost per capita per annum for 1927 was $1.0001.
Average 39 cities—Average annual increase in the cost per capita per annum for approximately five years was 4.7 per cent.
*The estimates of the U. S. Bureau of the Census were used for population figures except in cities thus marked. Local data and other sources of information were used here.
†Some cities did not give 1922 costs. In these instances the figures in parentheses represent years over which change occurred.

Fixed Moving Days and Effect on Utilities

THE spring and fall moving of tenants in Chicago has reached such proportions as to be an almost intolerable burden on the utilities, movers, builders, furniture stores, etc. The accompanying graph shows the condition resulting from this practice. In an attempt to correct the condition shown there has been formed the "Chicago Homes Economic Council," on which all interested parties are represented. The work before the council, according to Oliver S. Turner, vice-president of a large realty firm, who spoke on this subject to the Electric Association of Chicago recently, is very difficult



Effect of customers' moving on contracts taken weekly by Commonwealth Edison Company and Detroit Edison Company

because no individual or firm controls a sufficient number of the more than 600,000 apartments in the city to be a leader in a corrective movement. However, more than 750 renting agents have pledged themselves to make any month leases instead of only May and October.

Information secured from Harold Wright, superintendent of the application bureau of the Commonwealth Edison Company, reveals the excessive load that is imposed on this one utility by the semi-annual flitting of tenants. Although clerical forces may be somewhat expanded to cope with the situation, it is not possible to make adequate enlargement of the field organization. New men lacking training and experience cannot be hired and sent out on meter setting and reconnection work. Only work pertinent to handling moving orders is done during peaks. The men work from 7 o'clock in the morning to 9 at night and all day Sundays to keep up.

Unfortunately, some customers cannot move (because vans are not available or decorators interfere, etc.) on the date set, thus increasing the number of calls to the premises. The result is that tenants moving into new homes the first of May and the first of October do not receive the quality of service the company would like to render. On April 30 last the application bureau received 8,855 telephone calls from tenants moving. About 1,350 of these calls came in during the first hour of the working day. The average for the day was 26.86 calls per hour for each operator, each call requiring an average of 2.2 minutes. In addition the person-to-person contacts of the application bureau reached a peak of more than 2,000 on April 23.

Letters from Our Readers

"Puncture Tests Affected by Strength of Oil"

To the Editor of the ELECTRICAL WORLD:

In regard to the interesting article entitled "Puncture Tests Affected by Strength of Oil," by Messrs. J. T. Littleton, Jr., and W. W. Shaver, I believe that an erroneous effect is created by comparing the results obtained under oil with those under compressed air and then leaving the impression that the latter results represent those usual under atmospheric conditions.

Results obtained under compressed air cannot be said to be indicative of those under air at atmospheric pressure. The dielectric strength of air in these cases is widely different, just as the oil and atmospheric air dielectric strength are different. When the words "in air" are used, it is usually assumed that this means air at atmospheric pressures.

The different results given in Table I are due to the different stress distributions on the insulator when surrounded by the various mediums. There is one stress distribution for the insulator in air at atmospheric pressures, another when compressed air is used, another for oil of a low dielectric strength and another for oil of a high dielectric strength.

I do not believe the results will vary much if a good grade of oil, testing between 35 and 55 kv. for 0.2 in. gap, is used. The A.I.E.E. might well introduce into its test standards No. 41 some limitations as to dielectric strength of the oil in which the insulator is to be tested for puncture.

This article opens up the question of the effect of the liquid and gaseous medium upon a submerged solid dielectric which is under test. The solid dielectric is under electric stress, as is also the surrounding medium. It might be stated that from a source of electric stress all contiguous matter is under stress. The surrounding matter, liquid or gaseous, has an effect upon the dielectric strength of a solid submerged insulator because the stress distribution upon the insulation is different with different surrounding media. This is in line with the writer's previous articles in the ELECTRICAL WORLD on the subject of shielding and air circulation. Perhaps the time will come when the conception of an electrostatic field will be replaced by the reality of stress distribution, with resulting flow of electricity and stress gradients thereby established.

C. L. KASSON.

Boston, Mass.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

A Study of Spontaneous Combustion in Storage Coal.—A. J. HOSKIN.—An effort to evaluate the findings of practice and theory in regard to the problems and solutions involved in the spontaneous combustion of storage coal has been undertaken by the author. Conclusions derived by other investigators have been given consideration. The determinations apply largely to Indiana coals but are applicable to others. The characteristics of bituminous fuel, the features of various storage systems and open air influences accompany an exposition of the theory of autogenous heating. The important factors involved in practice, the duration of the storage period that is recommendable and the emergency practices for the control of heating have likewise been considered, as has the effect of storage upon the fuel value of the coal itself.—*Bulletin of Purdue University,* April, 1928.

Generation, Control, Switching and Protection

Developments in Current-Transformer Design.—The only suitable design of current transformer for use on large systems where heavy fault currents are likely to occur is, according to the author, the straight-through or single-turn bushing type having a primary conductor of the same current-carrying capacity as the circuit cables. Limitations of output and difficulties in arranging compensation have so far limited its application for metering purposes to circuits of about 300 amp. and upward. For smaller current values the primary ampere turns are insufficient to provide the necessary accuracy for metering purposes and the current transformers can only be used for actuating relays, oil-breaker tripping devices and similar installations where ratio and phase-angle errors are of little or no importance. The present discussion covers the application of a new magnetic alloy, "Mumetal," which, it is said, has solved a great number of the difficulties that must necessarily be surmounted and brings the universal application of the single-turn current transformer more nearly within the bounds of possibility. Several methods of obtaining closer compensation are suggested.—*Electrical Review,* May 11, 1928.

Oil Switch Tests.—J. KOPELIOWITCH.—In late years many statements have appeared in print giving rupturing capacities of high-voltage oil switches. From the results of these tests certain conclusions have been made regarding the suitability of the breakers. The author believes that these conclusions warrant a more critical investigation before definite judgment is passed upon the value of the tested breaker. It is emphasized that the stress upon the switch must be considered and calculated. Rupturing phenomena are compared on switches with explosion chambers and with open multiple breaks. These comparisons are made first on a model switch in a glass oil tank, photographed with a high-speed motion-picture camera, and then on actual field tests with energies of up to 725,000 kva. In both cases, the author claims, the explosion chamber oil switch was found inferior, because the rupturing arc lasts considerably longer and leads frequently to mechanical damages due to the very high gas pressures generated and needed for the proper function of the chamber. Multi-break switches, with so-called "solenoid contacts" and sphere-shaped arcing contacts, on the other hand, gave clean and quick ruptures of large energies with a minimum of wear. It is pointed out that the design of modern oil circuit breakers cannot be based on purely scientific or mathematical conclusions. Results so obtained must be largely augmented and frequently altered by experimental investigations on a large scale, comparable to actual operating conditions. *Elektrotechnische Zeitschrift,* May 3, 1928.

Transmission, Substations and Distribution

Rubber Gaskets for Mercury-Arc Rectifiers.—A. SIEMENS.—Gaskets for large mercury-arc rectifiers present a considerable problem. They must be vacuum tight, should not give off gases, must resist heat, must withstand expansion and contraction, should be simple and of long-wearing quality. After a great deal of research work a rubber gasket has been developed which answers all the above requirements. However, the rubber used is of special type. A novel, accelerated vulcanization process makes it possible to reduce the required amount of sulphur to a minimum, and a subsequent high-temperature vacuum treatment removes the remainder of it. To avoid any contact between the rubber and the mercury vapors an annular soft iron spacer is placed around the inner edge of the gasket. Tests made on such gaskets at alternately high and low temperature gave excellent results. A life of at least four years may be expected from these gaskets. The fact that these gaskets can be used repeatedly for opening and closing the same joint is of great economic importance, since any other known packing materials is destroyed after a joint is once broken.—*Siemens Zeitschrift,* May, 1928.

Units, Measurements and Instruments

Vector Calculating Devices.—M. P. WEINBACH.—In the analysis or solution of alternating-current problems it is frequently necessary to convert vector quantities from the exponential or polar form into complex numbers, or vice versa. The author has described a device by means of which such conversions may be performed mechanically and also a similar mechanical contrivance by means of which vector quantities expressed exponentially may be added or subtracted without prior conversion into the complex numbers. A slide rule with trigonometric and hyperbolic scales so disposed that conversions of vector quantities from one mathematical form into another or the evaluation of trigonometric or hyperbolic functions of complex variables may be obtained with ordinary slide rules.—*Journal of the American Institute of Electrical Engineers,* May, 1928.

Heat Applications and Material Handling

Melting Sterling Silver.—ROBERT H. LEACH.—Operating data obtained in the melting of sterling silver in high-frequency furnaces are offered by the author. The performance of both the oscillator and motor-generator types is given, as well as the relative efficiency of the air-cooled and the water-cooled coil when used with the generator type. A brief summary of costs has been prepared comparing the operation of the high-frequency furnaces with that of oil-fired furnaces for similar purposes.—*Report American Electrochemical Society,* April, 1928.

Welded Construction for Large Shop Building.—A special automatic welding machine has been applied to the fabrication of the built-up columns and girders for use in a large shop building. This type of construction has been applied to a large mill building, 340x135 ft. in ground dimensions. Details of the construction of the welded columns and information regarding the automatic machines have been included. The girders were fully tested upon completion of the fabrication work and results are said to have been pre-eminently satisfactory.—*Engineering News-Record,* June 7, 1928.

Electrophysics, Electrochemistry and Batteries

Simple Rectifier.—O. IRION.—For reasons which have not been fully explained, according to the author, the contact resistance between certain

metals and their oxides varies greatly, depending upon the direction of flow of the current passing through the two. A contact between a copper disk and a disk made of copper suboxide, Cu_2O, practically blocks the passage in one direction and acts as a valve, making this combination suitable for rectifying purposes. To obtain both halves of a sinusoidal alternating current the customary bridge connection can be used. For charging small storage batteries of up to three cells a compact unit is marketed, which consists of a transformer and a plate rectifier. No attempt has been made to introduce a choke coil to smooth out the ripple, since the set is primarily intended for battery charging. Its over-all efficiency is more than 50 per cent.—*Siemens Zeitschrift*, May, 1928.

Traction

Electric Locomotives for Operating on Three Voltages.—Electric locomotives capable of operation on either 1,500- or 1,200-volt trolley wire service or 600-volt third rail service have been developed for an American railroad. Selective relays are provided so that the change-over from one system to another may be accomplished automatically. When the change-over is simply from the trolley wire to third rail or vice versa at the same voltage no dead section is necessary provided the two supply circuits are interconnected. A dead section over which the locomotive must coast, is, however, interposed between two sections which are being operated at different voltages. The mechanical details and features of control and relay operations have been outilined in this article, as have the local conditions demanding the development of such equipment.—*Engineering (England)*, June 1, 1928.

Telegraphy, Telephony, Radio and Signals

Beam Wireless Telegraphy.—N. Wells.—In supplementing a previous article in the same publication the author has developed polar curves as a result of an investigation of the theory underlying the beam aerial system. Two principles are involved, directional effect of spaced transmitting aerials and the reflection effect of free aerials suitably situated with respect to the transmitting aerials. The factors governing the determination of the phase and the general expression of the considerations involved in such conditions have been included. Expressions for numerical values involved have been developed and a polar diagram for the simple reflected system as well as for the extended aerial system is offered, as is a vertical polar diagram expressing the same factors.—*Electrical Review (England)*, June 1, 1928.

Book Reviews

Electric Control Gear and Industrial Electrification

By William Wilson. Oxford University Press: London. 361 pages, illustrated. Price, $8.50.

The economic application of electric motors to loads involves a study of the load, of available motors and of methods to control the motors. In this splendid book the author has attempted to survey industrial electrification from this point of view. The book is concerned primarily with the design, construction and use of control apparatus. But to understand these features of control and to apply them to industrial jobs require also an understanding of loads and motors. The author has given a very comprehensive treatment of these features in order to make a self-contained volume and to make the book useful for reference.

As is customary with many British engineering books, the author gives a historical introduction and then builds his text in a logical series of chapters, each complete in itself, and well illustrated. Direct-current motors, alternating-current motors, manual starters and controllers, resistance control, multiple-voltage and series-parallel control, starting of squirrel cage induction motors and synchronous motors, solid resistors, liquid rheostats, contactors, contactor coils, relays and installations, motor-generator control interlocks, electric braking, contactor systems, elevators and applications of motors and controls to various industries are topics treated thoroughly in a series of chapters. Many tables, good charts and illustrations and a thorough indexing make the work definite and practical.

While British practice and equipment are accented, the principles apply to American conditions also. It would have been well to have included features of remote control and speed control as developed recently, and perhaps supervisory control also belongs in the industrial control list, so rapid has been its development and use.

Elektrizität in der Landwirtschaft

By C. Buschkiel. Berlin and Leipzig: Walter de Gruyter & Company. 171 pages, 185 illustrations.

The purpose of this little volume, the twelfth of a series of Siemens Company manuals, is to lay before the agriculturist the possibilities of electric light, heat and power as applied to rural service and to enable him to give intelligent care to his electrical devices. The style is therefore necessarily descriptive, elementary and popular. In addition to the usual domestic and farm appliances, the American reader may find descriptions of equipment and methods which, it is believed, have not been introduced commercially in this country, but are apparently being promoted by German electrical manufacturers. Data are given on power requirements for various operations. Bells, sirens, signaling systems and radio receiving sets are also described. A schedule for the systematic care of equipment, taking account of its seasonal use, is an interesting feature.

Book Notes

Die Gleichstrommaschine, Vol. II. By Arnold and LaCour. Berlin: Julius Springer. 715 pages, 550 illustrations, eighteen tables.

This second volume of Arnold's well-known treatise, now in its third edition, revised by Dr. LaCour, deals with the structural features, computation and operation of direct-current machines. The revision includes the elimination of obsolete and rare forms, with increased attention to the design of high-speed machines of large output. Its recognized value to the designer may have obscured the fact that this work contains much material of interest to other engineers also, who will find useful the chapters containing analyses of performance under special conditions, for instance joint operation with batteries, use of flywheel sets and permissible conditions of starting large motors on full-line voltage.

Manuel Du Mécanicien Electricien. By H. DeGraffigny. Paris: Gauthier-Villars. 225 pages, illustrated.

This publication is a more or less elementary and practical discussion of the actual installation of electrical equipment such as high and low tension conductors and contains a thoroughgoing analysis of the practical aspects of electricity.

The book starts with the theory involved and leads up to the construction of the ordinary motor and electrical equipment of various types. It then proceeds to discuss direct and alternating current and their application. A separate chapter is devoted to the management of central stations and another chapter is devoted entirely to the mechanical aspects of transmission. Altogether the book seems to be a valuable treatise on the mechanical side of electricity and electrical equipment of every type, including just enough theory to meet the requirements of the electrical man who is not too familiar with the background of the principles.

Grundlagen der Wechselstrom Theorie. By P. A. B. Linker. Berlin, 1928: George Stilke. 245 pages with 131 diagrams.

The author endeavors in this book to present the most complex problems of alternating-current theory in the simplest possible mathematical manner. In many ways the presentations are novel in that a new and simpler way of approach has been indicated. Of great value are the chapters on high-frequency theory, where the treatment permits of direct application to practical purpose, such as radio communication.

Book Received

The Lineman's Handbook. By Edwin Kurtz. New York: McGraw-Hill Book Company. 547 pages, illustrated. Price, $4.

News of the Industry

Clock and Carillon Dedicated at Louvain

Acceptance of American Engineers' Gift to Belgian University an Important Feature in Inauguration Ceremonies on July 4 for the Restored Library

By Cable to the ELECTRICAL WORLD

WITH no serious disturbance due to the unfortunate dispute over the proposed inscription, the new library of the University of Louvain, Belgium, built by American subscription to take the place of the one destroyed in the World War, and the clock and carillon installed in the library tower by engineers of the United States in memory of American engineers who lost their lives in that war, were dedicated at 2:30 p.m. on July 4 by Cardinal van Roey, Archbishop of Malines, in the presence of Prince Leopold of Belgium and his wife. Visitors from foreign lands, together with others from Brussels and nearby cities, joined with the citizens of Louvain in celebrating the event. Fully ten thousand people, including many Americans, witnessed the exercises. Speeches were made by the American Ambassador, Hugh Gibson; Dr. F. P. Graves, Commissioner of Education for the State of New York; Edward Dean Adams and others representing the American donors as they handed over the keys of the library and of the carillon to the rector of the university, Mgr. Ladeuze. The university representatives expressed great appreciation of the generosity of the American donors and the spirit of international comity manifested.

The ceremony included the delivery of the deed of gift and trust by Arthur W. Berresford, president of the American Engineering Council, and of a memorial record volume by Alfred D. Flinn, director of the Engineering Foundation. A flag bearing the insignia of the four major American engineering societies was presented to Louvain.

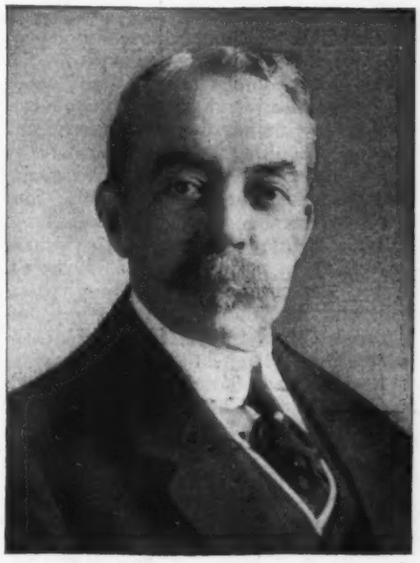
Immediately following the dedication a bust of Herbert Hoover was unveiled. Earlier in the day the visiting engineers were the guests of Belgian engineers at a luncheon in the Heverle Castle, at which Arthur W. Berresford spoke. A banquet in the great reading room of the library concluded the ceremonies, during the course of which Josef Denyn, the celebrated carillonier of Malines, played. The speech of Mr. Adams, upon whom the university a few hours earlier had conferred its highest honorary degree, won much applause.

The address from the American committee of engineers, which was read in French by the secretary of the university, in its original form reads as follows:

ADDRESS OF PRESENTATION

Louvain, July 4, 1928

To the glory of God and in memory of their fellow engineers who died in service during the Great War, 1914-1918, engineering societies of the United States of America present to the University of Louvain the carillon and the clock installed in the tower of the library of the university, the endowment fund of $10,000 for their maintenance, the honor roll of those who died, and a record of the names of all those whose contributions have made this memorial possible.



Edward D. Adams

Here on Belgian soil stands the only memorial to engineers of the United States of America who gave their lives in the Great War. How fitting the tribute and how proper its setting!

God's finger touched these men and they slept; but not the sleep of death, for in the peal of yon bells you may hear their immortal and triumphant song. Vibrant and jubilant it sounds. Merrily and cheerily it greets each breaking dawn, and the sweet and melodious measures hover at eventide like a benediction over this land. Because,

> There is in souls a sympathy with sounds,
> And as the mind is pitch'd the ear is pleased
> With melting airs or martial, brisk or grave;
> Some chord in unison with what we hear
> Is touch'd within us, and the heart replies.

It is this connection with what is unseen which gives this magnificent edifice its majesty and rhythm. The sacrifice in freedom's cause exalts and sanctifies this structure into a worship, a "Gloria in Excelsis," articulate in stone, leaping with aspiration toward heaven and chanting through unhorizoned expanse its beatific and seraphic psalm.

And how happy here the blending of the arts and sciences! "The conscious utterance of thought, by speech, by action, to any end, is art"; but the wondrous developments of science have but just begun, and as human intellects are chastened and refined by science, human hearts are widened to receive still higher and still nobler inspiration.

Since the beginning of civilization great universities have arisen to conserve and extend its spiritual triumphs, protecting them alike against the assaults of war and tyranny, the greed of unbridled commerce and the destructive spirit of the mob. We call these universities cloistered institutions, and in this aspect they appeal to all who value learning and love the esthetic arts.

But in our day universities have become more than this. They have been woven by modern science into the warp and woof of life as it is lived outside the college walls. To them the world's leaders turn for practical guidance. Their researches, no longer merely academic, are translated into the activities of progress, and mighty turbines throb, express trains speed through the night, airships fill the heavens, the human voice is heard around the world, because of what is wrought at college seats by the votaries of science to whom inventors turn for aid.

Engineering, dominating the modern world, to its infinite gain, is no longer an intruder, if it ever was, in the schools of higher learning. In them it is playing a part which has broadened from year to year, bringing perhaps to other departments of the college an impulse from the spirit of modernity sometimes a little lacking there, and reaping in return some of the ripe fruits of intellectual culture it needs to temper its own mechanistic spirit.

In the atmosphere of Louvain all rival clamor ceases, and the sciences and the humanities blend their individual pretensions in harmony with the influence of the eternal verities that surround such consecrated places. Here, therefore, it is very

fitting that American engineers should set a symbol that for ages to come will speak of their delight in helping to restore a seat of beauty, of learning, and of leadership in the engineers' own chosen sphere as well. It is appropriate, too, that the memorial chosen should be one that will be both seen and heard, for seeing and hearing are of engineering's essence.

May victories for civilization and progress fill the years to come as the great hands of yonder clock slowly mark time's passage, and may the mingled voices of those great bells carry throughout this venerated land and even across the seas—how strange to say it literally!* carols of international friendship and unbroken peace!

EDWARD DEAN ADAMS, chairman, representing Engineering Foundation and Engineering Societies Library.
GEORGE W. FULLER, representing American Society of Civil Engineers.
ARTHUR S. DWIGHT, representing American Institute of Mining and Metallurgical Engineers.
C. M. SCHWAB, representing American Society of Mechanical Engineers.
A. W. BERRESFORD, representing American Institute of Electrical Engineers.
GEORGE GIBBS, representing United Engineering Society.
LENOX R. LOHR, representing Society of American Military Engineers.
ROY V. WRIGHT, ex officio, president United Engineering Society.
ALFRED D. FLINN, Secretary.

At Brussels on the following afternoon the American delegates were received by Burgomaster Max at the City Hall. Other entertainment and attention was plentifully provided. A reception at the United States Embassy and a visit to the engineering school at Louvain were events that preceded the ceremonies on the Fourth.

Following is a list of the delegates from the United States who were present at the ceremony:

Of the Committee on War Memorial to American Engineers

Edward Dean Adams, Arthur W. Berresford, Arthur S. Dwight, Alfred D. Flinn, L. R. Lohr.

Official Delegates of Engineering Societies

American Society of Civil Engineers: George S. Davison, William J. Barney, William K. Hatt, George T. Seabury.

American Institute of Mining and Metallurgical Engineers: Ronald Clark, Millard K. Shaler, Firmin Van Bree.

American Society of Mechanical Engineers: Laurence V. Benet, Henry S. Downe, Clarke Freeman.

American Institute of Electrical Engineers: John W. Lieb, William H. Onken, Jr., Michael I. Pupin.

American Institute of Consulting Engineers: E. P. Goodrich.

American Institute of Chemical Engineers: Charles L. Reese.

Society of Naval Architects and Marine Engineers: J. O. Gawne.

Society of Automotive Engineers: Arthur Jarvis Slade.

Cast in Croydon, England, the Louvain carillon is one of the finest yet made. The Bourdon, or "great bell," is 89 in. in diameter and weighs 15,646 lb. The great clock has four dials, each 16 ft. in diameter and of special design.

*It had been hoped that it would prove practicable to transmit the carillon music by radio to America.

S.P.E.E. in the South

Engineering Educators Visit Three Universities in North Carolina During Convention with Record Attendance —Encouraging Reports Are Made

NEARLY every technical school in the country was represented at the thirty-sixth annual meeting of the Society for the Promotion of Engineering Education, held on June 26, 27 and 28 at the University of North Carolina, Chapel Hill. The registration was more than 350, the largest in the history of the society. The original four-day program was shortened to three days, and several scheduled papers of promise were crowded out.

The report of the board of investigation and co-ordination by Dr. C. F. Scott of Yale and W. E. Wickenden received much prominence. Charged with the responsibility of keeping engineering education abreast of industrial advancement, this board is doing most important work. A critical appraisal of engineering education in the United States was followed by recommendations for future organization and activity.

Much interest was also manifested in the report of the success of the special summer school sessions inaugurated last year for engineering teachers. Similar sessions are now under way at the Massachusetts Institute of Technology and the University of Pittsburgh. Plans for next year concentrate on a single session devoted to one of the major divisions of the curriculum. As a further incentive for attending the summer school, efforts are being made to secure allied courses running concurrently with the S.P.E.E. sessions, for which academic credit will be given by the university acting as host.

A feature of the meeting was a paper by R. I. Rees, American Telephone & Telegraph Company, on "College Experience in Its Relation to Achievement in Industry." By the use of charts Mr. Rees made a striking and favorable comparison between the advance of the employees within the company and their relative academic standing in school. In the same way extracurricular activities made a favorable score on the charts. The somewhat prevalent belief that academic standing and outside activities have no bearing on a career after leaving school was thus damaged.

The delegates were guests of Duke University at Durham one evening and were shown the recent twenty-million-dollar development of an entirely new university in an estate of 5,000 acres. Group conferences on teaching problems and the annual banquet completed the meetings at Chapel Hill. The closing sessions were held at North Carolina State College at Raleigh, followed by a barbecue at the Cape Fear plant of the Carolina Power & Light Company.

Ohio State University, at Columbus, Ohio, was selected for next year's meeting. The new officers are: President, Dean Dexter S. Kimball, Cornell; vice-presidents, Dean C. C. Williams, University of Iowa, and Dean G. M. Braune, University of North Carolina; secretary (re-elected), F. L. Bishop, University of Pittsburgh; treasurer, W. O. Wiley, John Wiley & Sons.

Central Maine Will Build 40,000-Hp. Hydro Plant

In the next few months the Central Maine Power Company will begin the construction of a 100-ft. dam and 40,000-hp. hydro-electric station on the Kennebec River in the town of Moscow, at an estimated cost of $7,000,000, according to an announcement of President Walter S. Wyman on Monday. It is expected that the dam will be completed near Bingham in the spring of 1931, and it is hoped to get the work well under way before next winter.

Mr. Wyman pointed out that the growth of the company's business, coupled with increasing demands for power from the Cumberland County Power & Light Company, a newly acquired subsidiary of the New England Public Service Company, seems likely to require 190,000,000 additional kilowatt-hours for the Central Maine and Cumberland companies by 1933, which is about the output expected from the Bingham plant. While the Bingham development will produce power considerably cheaper than any present station of the Central Maine, Mr. Wyman said that the company cannot obtain the cheapest power that can be had on this river until its largest site is developed, which cannot be done now because of the prohibition of exportation.

F. D. Comerford Explains Hydro-Electric Plans

A petition for the right to construct two hydro-electric plants at Fifteen-Mile Falls in the Connecticut River, New Hampshire, and to distribute electrical energy to public utilities and municipalities was heard by the Public Service Commission of New Hampshire on June 27. Plans for this development are complete and call for the expenditure of about $40,000,000. Two dams with hydro-electric plants, each operating under a head of approximately 150 ft. and together capable of developing around 200,000 kw., are the outstanding features of this project. In addition, a network of interconnecting lines with steam plants is included, linking up with the New England Power Company, of which the Grafton Power Company is a subsidiary.

As outlined by Frank D. Comerford, president of the New England Power Association, Boston, the purpose of this development is to bring into central New England hydro-electric energy at a low cost and uniform supply. These can be obtained through the co-operation of the States of Vermont and New Hampshire and by a large outlay for the construction of storage reservoirs and transmission lines which will insure a balanced output of energy through the periods of intermittent river flow. Three years will be required for the completion of the undertaking.

Testimony from Bureaus of Middle States

Former Secretary of Indiana Information Committee Admits Payment to Registered Lobbyists—Trade Commission Investigation Shifts to Michigan, Wisconsin and Ohio

TESTIMONY dealing with state legislative activities by the former Indiana Committee on Public Utility Information was brought out at the Federal Trade Commission's hearing on June 28 under the examination of Robert E. Healy, the commission's counsel. The witness was John C. Mellett, formerly executive secretary of the Indiana Committee on Public Utility Information and former secretary and treasurer of the Indiana Electric Light Association.

Judge Healy asked Mr. Mellett to explain three payments aggregating $12,056 during the years 1923, 1925 and 1927 to W. C. Frazee of Rushville, Ind. The witness said Mr. Frazee was a registered legislative agent of the Indiana Public Utilities Association and had represented that organization while the Legislature was in session. Regarding three payments totaling $1,596 to H. C. Adams of Indianapolis, over the period from 1923 to 1927, Mr. Mellett testified that Mr. Adams supplied the association with typewritten copies of all bills introduced and alterations in bills at the regular session of the Legislature and that the payments mentioned were for such services. He added, under examination, that the association in 1927 had paid $2,500 to Frank O. Cuppey, one-time secretary of the Indiana Telephone Association and now secretary and manager of the Lafayette Telephone Company of Indiana. It developed further that a check for $1,000 made out to Mr. Mellett and cashed by him had been turned over to Mr. Cuppey. The witness testified also that the association had made a payment of $500 in 1923 to C. L. Kirk, vice-president of the Citizens' Gas Company of Indianapolis.

Mr. Mellett said he was not informed as to why the payments had been made to Mr. Cuppey and Mr. Kirk, remarking that Mr. Cuppey at the time he received the checks was a registered legislative agent.

On June 29 Alfred Fischer of New York, formerly director of the Michigan Committee on Public Utility Information, told of a survey made by his committee of a textbook on civil government used in the Michigan schools. The textbook, he said, contained statements of a controversial nature which it was felt could be made more accurate if the book were reissued, but that was never done. Mr. Fischer denied that speakers or college professors had been paid to distribute propaganda for the utility companies. The bureau was kept up by the gas and electric associations and cost from $11,000 to $14,000 a year, the testimony showed. Friendly contact with newspaper editors was maintained.

Arthur W. Stace, director of the Michigan committee, took the stand the following day. It was developed during his testimony that ten thousand pamphlets on gas and electricity had been distributed by his committee to Michigan schools. He had written, he said, to the superintendents of the schools offering to supply the pamphlets.

Before the investigation was suspended for the week an exhibit was put in the record in the form of a letter from A. S. Hillies, secretary of the utilities publication committee, of Washington. This letter suggested to O. D. Young and others to whom it was sent that the National Association of Railroad and Utilities Commissioners was in debt $1,600 and that the utility organizations would be ustified in helping it.

On Monday, July 2, A. F. Herwig, director of the Wisconsin Public Utility Information Bureau, told about preparations made by the Joint Committee of National Utility Associations last year for the proposed Walsh investigation. A report on a conference between the joint committee and about one hundred state publicity directors and utility executives on Oct. 11, 1927, which Mr. Herwig identified, said that the "fears of state committees that they might be involved in politics by the joint committee were allayed by statements of P. H. Gadsden and G. B. Cortelyou."

Another development on Monday was a report of a meeting of public utility men in Atlantic City in 1922, at which Benjamin E. Ling, then director of the Ohio Information Bureau, was quoted as saying his committe paid G. C. Maxwell, former secretary of the Ohio Public Utilities Commission, $3,600 a year and expenses for making speeches, without letting the hearers know that he was employed by the publicity organization, with the object of insuring more newspaper attention to what the speaker might say.

In the same report B. J. Mullaney of Chicago, director of the Illinois committee, was quoted as saying: "We are trying to promulgate the idea rapidly among the newspapers that public utilities offer a very fertile field, developing regular, prompt-paying customers for the advertising columns of the newspapers."

On Tuesday it was again the turn of Wisconsin, and J. N. Cadby, secretary Wisconsin Utilities Association, took the stand. Money to finance three fellowships of $500 each for engineering study at the University of Wisconsin is furnished by the association, Mr. Cadby said, adding that disposition of the fund was left entirely to the university authorities.

Mr. Cadby was able to answer readily and apparently satisfactorily all questions asked. Much was made by hostile writers of the fact that Commissioner E. I. Lewis of the Interstate Commerce Commission had commended the work of the textbook committee in bringing up to date some of the books purporting to present a well-rounded picture of the part the utilities play in the economic scheme. One of the principal changes sought was a proper development of the fact that the utilities are regulated by representatives of the public. Mr. Cadby pointed out in a letter introduced in evidence that "Community Civics," by R. O. Hughes, in all its discussion of the public utilities, fails to mention the fact that the industry is regulated. The author himself agreed with the criticism, and Mr. Cadby testified that Mr. Hughes had written him saying that the necessary alterations would be made when the book was revised.

Mr. Sheridan's Resignation Is Not Accepted

The Missouri Committee on Public Utilities Information, meeting in executive session at St. Louis last week, refused to accept the resignation of J. B. Sheridan, secretary of the committee since its inception seven years ago. Mr. Sheridan is supposed to have tendered his resignation because of adverse criticism on his testimony before the Federal Trade Commission investigation. "The purpose of the committee is to disseminate fair and authentic information about public utilities and public utility service, and its members have not changed their belief in the propriety and importance of this work to the users of public utility service, to the utility companies and to the public at large," a statement issued after the meeting read.

Indiana Much Interested in Testimony on Schools

Testimony before the Federal Trade Commission in Washington concerning the activities of the Indiana Committee on Public Utility Information is receiving columns of publicity in Indiana papers, and school authorities particularly are being interviewed as to their connection with the alleged propaganda. State educational officials and Indianapolis high school principals are unwilling to concede that any objectionable action or material was sanctioned by them. William Lowe Bryan, president of Indiana University, says he intends investigating the aid the Indiana Public Utilities Association gave the university in 1925, when a supplemental series of lectures by practical utility men was introduced in the School of Commerce course.

Educators Will Investigate Propaganda in Schools

The board of directors of the National Education Association, which held its annual convention in Minneapolis this week, passed a resolution condemning propaganda in the schools and authorizing the appointment of a committee to conduct an investigation. It took this action after listening to the report of J. W. Crabtree of Washington, D. C.,

secretary of the association, in which he condemned the activities of public utilities service bureaus and called some of them "an insult to the intelligence of school authorities." Paul S. Clapp, managing director of the National Electric Light Association, appeared before the committee and asked that material submitted by the utilities for public school use be subjected to scrutiny.

"The association condemns propaganda of any character from any source in schools of the country," Mr. Clapp declared. "It will appreciate and welcome a careful study by the National Education Association of the entire question of relationship between public utilities and schools in the various communities throughout the country." He contended that of all the pamphlets printed only two have been found objectionable by the Federal Trade Commission.

The duties of the special committee to be appointed under the resolution are to learn what principles may be used to guide school authorities in the handling of material which may be classed as propaganda and to determine what machinery, if any, shall be set up as a protection to the individual school officer and teacher. The committee will be appointed by the president and will report at the 1929 meeting.

Purchases and Mergers

The Delaware & Otsego Light & Power Company has petitioned the New York Public Service Commission for approval of the transfer of its franchises and plant to the New York State Electric Corporation. The petitioner distributes electricity in the villages of Otego and Sidney and the towns of Franklin, Otego and Sidney. The commission will hold a public hearing.

Approval has been given by the Indiana Service Commission for the purchase by the Southeastern Indiana Power Company of the Battle Ground Light & Power Company for $24,994, the Milroy Light & Power Company for $70,595 and property owned by Everett M. Hurst in Kosciusko County for $20,963.

Formation of a corporation to be known as the Washburn Lignite Company has resulted from negotiations between the Otter Tail Power Company of Fergus Falls, Minn., and the Washburn Lignite Coal Company, which owns a large mine at Wilton, N. D., and has functioned as a light and power utility in that place. The Otter Tail Power Company, which furnishes energy to 240 towns and cities in the Dakotas and Minnesota, thus comes into control of the mine and its electrical business.

The Cross Country Electric Company, a rural organization at Middleton, Wis., has been purchased by the Wisconsin Power & Light Company.

A committee of the City Council of Forrest City, Ark., has reported in favor of a survey of the municipal light and water plant with a view of possible sale to the Arkansas Power & Light Company, which would like to buy it.

By an agreement between the Gulf Public Service Company and the city trustees of Lafayette, La., the company has withdrawn its offer for the city's light and water plant, thereby abolishing an election which had been called for July 6 and leaving one bidder, the Gulf States Utilities Company, in the field. An election on the latter's offer of $800,000 is scheduled for July 30. In the meantime Sherritt & Company, New Orleans, have offered $1,000,000 for the plants.

The Southern Cities Utilities Company has renewed its endeavors to acquire the Tullahoma (Tenn.) light and water plants, offering $171,000.

Receipt of a check for $200,000 from the Dominion Electric Company has closed the deal involving the sale to it of the municipal plant at Estevan, Saskatchewan, Canada. A new plant will be built by the company.

Iron and Steel Engineers at Chicago

Good Papers Hold Attention of Steel-Mill Men—Electric Heating Applications Attract Interest—Exposition of Equipment Contains Many New Devices

APARITY in interest and importance between heat and power applications of electricity in the iron and steel industry was indicated in some degree at the convention of the Association of Iron and Steel Electrical Engineers in Chicago last week. Two of the general committee reports of the meeting were on these subjects.

Speaking on electric heating, the committee, through its chairman, G. H. Schaeffer, emphasized the lowering trend of average power costs brought about by the operating and management economies following the utility consolidations of the past seven years. This trend, though it has not yet brought electricity to a point of comparison with other means of heating on a B.t.u. basis, combines happily with inherent advantages to make the total cost of electric heat processes increasingly attractive.

A review of the past year's developments in electrical applications in the industry was presented by W. H. Burr, committee chairman. During 1927 there were purchased 122 main-roll-drive motors ranging in size from 300 hp. to 7,000 hp., of which more than half were direct-current and 80 were used with gear drives, indicating a growing belief in the reliability of this type of drive. Descriptions of recent installations outstanding in regard to novelty or size, together with discussions of control and switching methods, were included in this report. A. G. Place, chairman of the electric welding committee, presented a comprehensive report on methods of welding, while the report of the standardization committee consisted of the final outline dimensions of the standardized mill-type motor.

The technical sessions of the convention were marked by many papers of practical value to the operating steel-mill engineer. The methods and systems used in high-tension practices in modern plants were treated in a paper by Eugene Vinet which reviewed the practices, materials and equipments for voltages above 33,000. A companion paper on "Steel-Mill High-Tension Practices," by F. O. Schnure, set forth the routine methods of operation to result in safety and continuity of service. This subject was treated also in a paper by R. M. Hussey which treated of the "Rules and Regulations Pertaining to the Operation of a Steel-Plant High-Tension System," citing a particular system.

A discussion of the virtues of group drive versus individual motors on roll-out tables was given in a paper by J. C. Dobelblower. The group drive will persist on account of the personal leanings of designers, but the paper indicated a belief that the single-roller drive will largely expand in the future. A. F. Kenyon explained the power calculations and described the design requirements in the selection of main-drive motors for strip and skelp mills. In treating of the selection of motors for main drives of merchant, bar and rod mills, C. B. Huston described the layouts of a number of foreign and domestic installations and indicated the requirements of these applications.

"A Discussion of the Elements Entering Into the Cost of Producing Power" was the title of an excellent paper by W. B. Skinkle. This paper, aside from its value to the steel industry as a producer of its own power, would repay study by central-station men both as a possible commentary on their own methods and as an instrument to be used in power sales work. The costs in the paper were largely referred to blast-furnace gases for fuel, but the methods of allocation, which were described in detail, would be of interest to any electric power producer. The analysis was divided into two parts, one concerned with steam production and the other with energy after the steam is supplied. A number of curves, graphs and tabulations set forth the analysis in a wholly admirable way.

The remaining papers in the technical sessions were not so closely connected with electrical subjects, the considerations covered being insulation of open-hearth furnace regenerators, boiler pressures above 500 lb., factors governing the purchase of coal, instruments in the iron and steel industry and anti-friction bearings.

During the convention three special luncheon meetings were held. At the first of these, under the auspices of the safety engineering division, there was an address by L. H. Burnett, vice-president of the Carnegie Steel Company. At the other two demonstrations were given of the "televox" and of making sound visible and light audible. The exposition of equipment and apparatus that always accompanies this association's conventions aroused enthusiasm. Ninety-seven exhibitors had space in the exhibition hall of the

Stevens Hotel. Many new developments, including the grid-glow-tube, photo-electric-cell control devices, were featured. The convention attendance was about 800 registered. Many more visited the exposition.

Governor Hunt of Arizona to Ask Seventh Term

Desire to serve his state in fighting against the passage of the Boulder Dam bill has prompted Governor George W. P. Hunt of Arizona to seek his seventh term as the highest executive of the state, according to his announcement. A caustic attack on proponents of the Colorado River measure and bitter condemnation of the Republican state delegation which cast its vote for Herbert Hoover in Kansas City marked the announcement that he was to be a candidate for re-election in the Democratic primaries in September.

"I do not feel that any other candidate so far announced could aid in fighting the Boulder Dam bill with any degree of success," Governor Hunt declares. "The Republican state delegation deserted a trust by throwing its support to Herbert Hoover at the national convention in Kansas City. Hoover, as Secretary of Commerce, has been in a position to exercise great influence in the Colorado River controversy. He has consistently thrown the powers of his office against the interests of the State of Arizona."

Democratic Party Has Water-Power Plank

Unlike the platform of the Republican party, the Democratic declaration of principles adopted at Houston last week has a plank on water power. It is as follows:

The federal government and state governments respectively now have absolute and exclusive sovereignty and control over enormous water powers, which constitute one of the greatest assets of the nation. This sovereign title and control must be preserved respectively in the state and federal governments, to the end that the people may be protected against exploitation of this great resource and that water powers may be expeditiously developed under such regulations as will insure to the people reasonable rates and equitable distribution. . . .

We favor appropriation for prompt coordinated surveys by the United States to determine the possibilities of general navigation improvements and water-power development on navigable streams and their tributaries and to secure reliable information as to the most economical navigation improvement, in combination with the most efficient and complete development of water power.

We favor the strict enforcement of the federal water power act, a Democratic act, and insist that the public interest in water-power sites, ignored by two Republican administrations, be protected.

The platform makes no specific allusion to Muscle Shoals or Boulder Dam, nor is there any mention of the "power trust."

Detroit's New 'White Way'

Washington Boulevard Illumination Raised to 5,000 Watts per Standard—Called World's Brightest Street—28 Standards 100 Ft. Apart

HIGH-INTENSITY street illumination will take another forward step with the inauguration next Tuesday, July 10, of a system which it is declared will make Washington Boulevard, Detroit, the most brightly lighted street in the world. The project is being financed by the Washington Boulevard Association, which will present the installation to the city.

A parkway extending the full length of the avenue affords an excellent location for erecting the standards. These standards are of ornamental design, made by the Graybar Electric Company. Each standard supports five units of 1,000 watts each, thus totaling 5,000 watts per standard and considerably exceeding the intensity per standard on State Street, Chicago. The standards are placed 100 ft. apart. Twenty-eight standards have been erected along the four blocks of parkway, in double rows in the middle of the street, and an aggregate of 140,000 watts will light the boulevard. The units will be so switched that during the early morning hours, when the high-intensity system is not needed, all but the top units can be turned off.

Old and New Standards on Washington Boulevard

The glass globes used to inclose totally the 1,000-watt lamps are made of a heat-resisting alabaster glass and are supplied by the General Electric Company, in whose laboratories the plans for the new system were worked out.

To arouse public interest arrangements have been made to turn on the lights next Tuesday by radio signals transmitted from an airplane flying over Detroit.

Southern Canada Power Wins Appliance Sale Contest

An interesting competition took place between many of the leading hydro-electric distribution companies in Canada between Sept. 1, 1927, and April 30, 1928. This was a contest in the sale to customers throughout Canada of domestic electrical appliances of various kinds. The sales were made through branch stores operated by the power companies and resulted in a total for the period of nearly $750,000. In Group 1, composed of those stores that had been in operation for more than one year, first and second prizes were taken by the Southern Canada Power Company, Montreal. The highest record was made by its Knowlton (Quebec) store with the unusual average of $17.88 for each customer, and the second highest average, $10.25, was shown by its Richmond (Quebec) store. The British Columbia Electric Railway Company was a close third with an average of $10.22 per customer for its New Westminster store. The Southern Canada Power also won fourth, fifth and sixth places for sales at other branch stores.

The contest was organized by the Canadian Electrical Association, of which the companies mentioned above are members. Each first prize consisted of $200 cash, with $100 to the winners of the second prize in each group.

Los Angeles Power Bureau's Budget, $23,125,000

The Bureau of Power and Light of Los Angeles has prepared a budget of $23,125,000 for the next fiscal year. Of this sum, $7,300,000 is to be expended for extensions and betterments of the system. In the announcement officials of the department stated that this sum would have been $3,000,000 greater had it not been for the St. Francis Dam disaster, which curtailed revenue by about $1,000,000 and almost totally destroyed a two-million-dollar generating plant.

Included in the Power Bureau's budget, are the following items: Interest and sinking fund, $3,436,000; purchase

of energy, $3,500,000 (from Southern California Edison Company); operation and maintenance, $4,419,000; purchase of Southern California Edison Company distribution system in recently annexed territory, $2,000,000; miscellaneous expenditures, $2,470,000. Revenues for the coming fiscal year have been estimated at $16,684,000. In addition to this it will be necessary to sell $6,441,000 worth of bonds during the year.

The bureau says that repairs to unit No. 1 in the San Francisquito Canyon plant have been completed and the unit has been placed in operation. The second unit will not be ready for some months. The rebuilding of unit No. 1 was done in the remarkably short time of ninety days. Reconstruction will cost the Bureau of Power and Light approximately $1,000,000.

Plans for Power Generation at Elephant Butte

Plans for the hydro-electric development of Elephant Butte Dam, which is a federal reclamation project, are thus reviewed by Roland Harwell, manager of the El Paso Water Improvement District, which is in charge of the project:

"The proposed development will consist of a power plant of 25,000 kw. capacity at Elephant Butte Dam. From the plant approximately 120 miles of transmission line will convey the energy at 110,000 volts to a substation approximately four miles north of El Paso, and the energy will be delivered at this point from the low-tension side of the transformers at 13,800 volts. The power plant, transmission line and the substation will be the property of the irrigation districts, and their construction cost is estimated at $2,100,000.

"The districts have secured from the Department of the Interior the privilege of utilizing all irrigation works, title to which is in the United States, for the period of 50 years for the purpose of generating hydro-electric power. It is proposed in the immediate development to generate seasonal power which may result from the release of water for irrigation purposes. While the irrigation season extends practically throughout the year, the major releases are made through a period of eight months, reaching a peak in July or early August. The average annual release is 787,000 acre-feet, and the amount of energy which may be developed is 100,000,000 kw.-hr. annually.

"The districts have negotiated the sale of 90,000,000 kw.-hr., but will pay this charge in monthly installments without reference to the immediate delivery of any energy. The electric company agrees to take and pay for a minimum of 50,000,000 kw.-hr. annually at the beginning of the contract and thereafter increasing amounts as its load permits. Energy in excess of 36,000,000 kw.-hr. annually is sold at the rate of $0.0044 per kilowatt-hour. The period of the contract is 25 years. The present proposed development is regarded as the first step toward the ultimate development of the full power resources of the districts by means of a secondary dam to be located 18 miles below Elephant Butte."

Briefer News

HYDRO SYSTEM AT WINDSOR, ONTARIO, TO BE EXTENDED.—Extension of the Hydro-Electric System at Windsor, Ontario, is to be made at a cost of $300,000. The extension will take care of two thousand new customers. Lands and buildings will cost $25,000; substation equipment, $80,000; distributing systems, $111,000; transformers, $40,000, and street lighting, $4,000.

DOTHAN, ALA., GOES UNDER PRIVATE CENTRAL-STATION SUPPLY. — After years of factional fighting that has given Dothan, Ala., many elections, that city has begun buying power from the Alabama Power Company under a five-year contract. The company is operating the municipal steam plant until its transmission lines shall be ready. Payment to Dothan includes the expense of generating plus 10 per cent and an additional bonus of $1,000 a month for the use of the steam plant as a standby unit.

NEW ENGLAND LIGHTING MEN GUESTS AT SCHENECTADY.—By invitation of the General Electric Company the Lighting Engineers' Club of New England held a two-day meeting at the Schenectady works beginning June 22, the program including visits to various of the company's laboratories, a considerable number of addresses on illumination practice and developments by specialists of the manufacturing organization, and street and airport lighting installation inspections. The club elected these officers: Chairman, W. S. Wallace, Charles H. Tenney & Company, Boston; vice-chairman, R. H. Bowman, Cambridge Electric Light Company; secretary and treasurer, J. J. Barry, Boston Edison company.

COMMERCIAL SECTION OF EMPIRE STATE ASSOCIATION MEETS AT UTICA.—A two-day convention of the Commercial Section of the Empire State Gas and Electric Association was held at Utica, N. Y., on June 28 and 29. The Utica Gas & Electric Company was host to the convention, and Frank B. Steele, vice-president and general manager of that company, made an address of welcome. William J. Reagan of the same company gave an address on "The Commercial Department and Its Organization." Consideration of merchandising problems was the main occupation of the delegates, of whom there were about two hundred, besides twenty-five members of the women's section. Manufacturing plants were visited.

NATIONAL ELECTRICAL CREDIT ASSOCIATION TO MEET JULY 16.—Among the topics to be discussed by the National Electrical Credit Association when it holds its thirtieth annual meeting at the Statler Hotel, Boston, on July 16 and 17 are installment sales, association publicity and service, credit as related to modern marketing, and bankruptcy law and practice. M. A. Curran, vice-president Bryant Electric Company, and Frank E. Watts are among the speakers announced. Secretary Frederic P. Vose will be toastmaster at the Monday banquet, when fourteen men who have occupied the post of president will sit at the head table.

SEEKING MARKET FOR COOPER DEVELOPMENT ON COLUMBIA RIVER BRANCH.—The preliminary permit issued for the development of the "Z" Canyon power project on the Clark's Fork branch of the Columbia River (known locally as the Metalline River) by interests headed by Col. Hugh S. Cooper provides that actual construction work must begin within two years. The "Z" Canyon site is directly north of Spokane and within a few miles of the Canadian border. The plans call for a dam 390 ft. high and for the ultimate development of 400,000 hp. Representatives of the promoters are busy in the Spokane district in a survey of power markets. They are particularly interested in the treatment of ores of that region by electrolytic processes.

PROGRESS ON MONTREAL ISLAND POWER PLANT.—Since the 65,000-hp. hydro-electric development on Back River, which will serve the requirements of the Montreal Island Power Company, was announced last fall virtually all the preliminary work has been completed. On the north side of the river, where the power house will be built, a portion of the river bottom has been unwatered and the excavation for the turbines is proceeding. This year all of the power-house substructure and the greater part of the dam are to be completed, leaving the power-house superstructure, the remainder of the dam and the installation of the machinery for next year. The plant is scheduled to have six 8,000-hp. units in operation by the fall of 1929.

EXPANDING TRANSMISSION SYSTEM OF KENTUCKY UTILITIES.—The Kentucky Utilities Company expects to complete by late summer its second circuit over the Ohio River between Barlow, Ky., and Mound City, Ill., which will connect the generating plants of the Central Illinois Public Service Company at Grand Tower and Muddy, Ill., with the western Kentucky lines of the Kentucky Utilities Company and generating plants in that section. The other side of the loop crosses the Ohio River at Morganfield. The new circuit is composed of three heavy power lines. The anchor tower on the Kentucky side is 131 ft. high and the River Crossing tower is 351 ft. high. The span will be

4,500 ft., and the three wires will be stranded aluminum over steel cores. Plans have been completed for spending $375,000 in construction of a new 44-mile, H-frame, 66,000-volt line and a 33,000-volt parallel line to connect the power generating plant at Pineville, Ky., with the Pocket (Va.) station of the Old Dominion Power Company, a subsidiary of the Kentucky Utilities.

BRITISH COLUMBIA COMPANY'S NEW STEAM PLANT WILL HAVE 80,000 KW. RATING.—The coming steam plant of the British Columbia Electric Railway Company, to be known as the Hastings steam plant and erected on Burrard Inlet, as already announced, is to have an ultimate rating of 80,000 kw. Contract for the first 20,000-kw. unit is already let, and it is expected to be completed by Sept. 1, 1930. It will be used for standby service and will burn pulverized coal, with provision for possible future use of fuel oil. The present steam plant operated by the company on Main Street, Vancouver, will be retained, so that there will be two reserve steam stations in case of hydro-electric shortage.

DELAYED LITIGATION OVER NORTHERN MINNESOTA DAMS.—Attorney-General G. A. Youngquist of Minnesota, answering a complaint of delay in the trial of the state's suit for damages alleged to have been done to state land by power projects, says that the state must rely to a considerable extent upon expected reports of the engineers for the International Joint Commission. The suits in question were instituted by the state in 1914 and 1917 to recover damages aggregating $275,000 against the Minnesota & Ontario Power Company, an E. W. Backus holding. In 1912 this company put into operation a dam at the lower end of Rainy Lake and in 1915 another dam at Kettle Falls, which controls the waters of Namakan and Kabetogama Lakes and their tributaries. Lands of the state and settlers were flooded. One settler's suit was tried in 1915 and dismissed, principally upon the ground that the plaintiff had failed to prove his damages.

EXPANSION CONTINUES IN OKLAHOMA.—Authorization has been received by the Oklahoma Gas & Electric Company for construction of 22 miles of 63,000-volt transmission line between Paul's Valley and the Etowah substation, together with the necessary switching equipment. This construction will serve the towns of Washington, Wayne and Paoli, which recently granted franchises to the company. Work will start immediately on 28 miles of 63,000-volt high line from Sulphur to Randolph, connecting with the Ardmore-Durant line, and a 7,500-kva. switching station will be built at Randolph. Work of installing the new unit at the Horseshoe Lake generating station near Harrah is progressing rapidly and it will be ready for service this fall.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see page 48 of this issue.]

Public Utilities Advertising Association—Detroit, July 9-10. T. P. Pfeiffer, Byllesby Engineering & Management Corp., Chicago.

East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.

National Electric Credit Association—Boston, July 16 and 17. F. P. Vose, 1008 Marquette Bldg., Chicago.

Wisconsin Utilities Association, Electric Section—Appleton, Wis., July 26 and 27. J. N. Cadby, 432 Broadway, Milwaukee.

National Electrical Manufacturers' Association—Policies Division, Association Island, Henderson Harbor, N. Y., July 29-Aug. 1. S. N. Clarkson, 420 Lexington Avenue, New York.

Camp Co-operation VIII—Association Island, Henderson Harbor, N. Y., Aug. 2-7. Society for Electrical Development, 420 Lexington Avenue, New York.

Association of Electragists International—Hotel Stevens, Chicago, Aug. 6-11. L. W. Davis, 15 West 37th St., New York.

American Institute of Electrical Engineers—Pacific Coast convention, Spokane, Wash., Aug. 28-31. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 5-7. H. A. Buch, Telegraph Bldg., Harrisburg, Pa.

Western Section, International Association of Electrical Inspectors—Cosmopolitan Hotel, Denver, Sept. 10-12. W. S. Boyd, 175 West Jackson Blvd., Chicago.

Illuminating Engineering Society—Toronto, Can., Sept. 17-20. L. H. Graves, 29 West 39th St., New York.

Rocky Mountain District, N.E.L.A.—Hotel Colorado, Glenwood Springs, Sept. 17-20. (With Colorado Utilities Association.) O. A. Weller, Public Service Co. of Colorado, Denver.

Empire State Gas and Electric Association—Saranac Inn, Upper Saranac, N. Y., Sept. 20-21. C. H. B. Chapin, Grand Central Terminal, New York.

American Electric Railway Association—Cleveland, Sept. 22-28. J. W. Welsh, 292 Madison Avenue, New York.

International Committee on Illumination, Saranac Inn, Lake Saranac, N. Y. Sept. 22-28. (See Illuminating Engineering Society.)

New England Section, N.E.L.A.—Poland Springs House, South Poland Springs, Me., Sept. 24-27. Miss O. A. Bursiel, Statler Bldg., Boston.

Great Lakes Section, N.E.L.A.—French Lick Springs, Ind., Sept. 27-29. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

GREAT NORTHERN POWER COMPANY OBTAINS FRANCHISE.—Despite a strenuous protest from the Puget Sound Power & Light Company, the application of the Great Northern Power Company for a franchise over certain roads and highways in Snohomish County has been granted by the county commissioners. The petition covers 39 roads and highways, and power lines will be extended, according to the franchise, to the Everett city limits and the King County line. The Puget Sound company asserted that the applicant would not serve any territory which is not now being adequately served and that "there is no reason to believe that it could maintain rates lower or as low as the rates now prevailing without losing substantial amounts of money." Vice-President Wallace of the Great Northern Power Company, of which J. E. Wickstrom is president, in answering the protest, declared that there is "a demand for power, because the rates are now too high. This demand will be met by the rates we propose to offer."

SALT RIVER VALLEY POWER PROJECTS.—Work on the 12,000-hp. hydro-electric development which the Salt River Valley Water Users' Association is to make at Stewart Mountain, Ariz., 12 miles below the Mormon Flat plant completed about a year ago, will soon start, according to information at Phoenix. The proposed Verde development in the same territory, where an ultimate output of 100,000 hp. is predicted, has a good chance of realization, and construction of a power plant at the Coolidge Dam, serving the Casa Grande Irrigation District, is awaiting only the near completion of that structure. Six hundred miles of 4,000-volt distribution lines will be built this year, at a cost of $1,300,000, to serve the farms in the valley.

EXPANSION PLANS OF NEW OWNERS OF ROCHESTER GAS & ELECTRIC CORPORATION.—Plans to weld the recently purchased Rochester Gas & Electric Corporation and the central and southern New York State units of the E. L. Phillips interests into a power system stretching from Lake Ontario to Pennsylvania and from the Genesee River to Lake Cayuga are believed to have been laid at a conference of the new owners with officials of the utility in Rochester. That city, according to general plans, will be the core of the new enterprise, which will include hydro-electric developments now under construction and proposed in the central and southern parts of the state. Niagara power still will be purchased at Rochester. Potential water power in the district reaching 100,000 hp., sufficient to fill all power needs, will be utilized, Mr. Phillips is reported to have said. A new company will be formed from the Empire Power Corporation and the Mohawk Valley Company, the name of which has not yet been established. The Mount Morris hydro-electric development in the Genesee River, which will, when complete, be capable of supplying the entire district with a constant power flow, is the biggest development facing the new owners. No detailed plans yet have been made for Mount Morris.

PROGRAM FOR PUBLIC UTILITIES ADVERTISING CONVENTION.—B. J. Mullaney, vice-president People's Gas, Light & Coke Company, Chicago, will preside over the opening session of the Public Utilities Advertising Association meeting to be held in Detroit on July 9 and 10 in connection with the international advertising convention and exposition, and W. H. Hodge, vice-president Byllesby Engineering & Management Corporation over the second day's session. D. M. Mackie will make his report as president. "Budgeting and Accounting for Advertising Expenditures" will be discussed by L. D. Gibbs of Boston,

T. P. Pfeiffer of Chicago and J. C. Costello of Chattanooga; "Reactions from the Broadcasting Field" by F. A. Arnold of New York; "Direct Mail Opportunities for Public Utilities" by Homer J. Buckley of Chicago, and "Are Advertising Costs in Line?" by E. Frank Gardiner of Chicago, L. K. Starr of Atlanta and T. H. Kettle of Minneapolis. Mr. Hodge will talk on "Contact with Stockholders," and "How Shall We Advertise Our Merchandise?" will be answered by Clara H. Zillessen of Philadelphia, Dorothy B. Fisher of Chicago, Dorothy Dignam of Chicago and Maurice Jacobs of Omaha. P. H. Gadsden, vice-chairman of the Joint Committee of National Utility Associations, will address the general session of the International Advertising Association on July 8 as a representative of the public utility group.

Commission Rulings

RATES AFFORDING 11.5 PER CENT RETURN SUSTAINED IN VIEW OF PROBABLE INCREASE IN EXPENSE.—The Nevada Public Service Commission sustained the water rates and the electric light and power rates charged in the city of Winnemucca by the Western States Utilities Company against a complaint by that city, despite the fact that a return of 11.5 per cent on the fair value was indicated. The commission pointed out that a reduction of gross earnings to diminish the return to an admittedly fair rate of 8 per cent would result in an average reduction of only 1.8 per cent in all rates and that a probable increase in taxation and operating expenses would be likely to absorb the margin of excess.

COMMISSION REFUSES TO CONCERN ITSELF WITH SALESMEN'S TALK.—A complaint by the municipal plant of Logan City, Utah, against the Utah Power & Light Company that the latter was inducing new patronage by representation that it would install the consumers' wiring free, in violation of its own rules and in unfair competition with the city, was dismissed by the Utah Public Utilities Commission where it was not shown that any salesmen or other persons making such representations were authorized to do so by the company and where the latter had never in fact done any free wiring of new consumers' premises. "While representations and offers on the part of solicitors and agents beyond those permissible under the established rules are not to be commended," the commission said, "unless the utility acts we are powerless to correct that practice. The commission cannot put a stop to the talk of sales agents of either party and will not undertake to do so."

PRINCIPLES THAT SHOULD GOVERN CANCELLATION OF RATE SCHEDULES.—Acting on the application of the Illinois Power & Light Corporation for permission to cancel certain rate schedules, the Illinois Commerce Commission laid down the three following principles: (1) The cancellation of a rate schedule under which there are no consumers being served and which is clearly obsolete or unjust either to the operating company or to its consumers should as a general premise be allowed. (2) There may be a proper justification for the cancellation of a rate schedule which is not obsolete, but under which no customers are being served, if prospective customers could be just as economically served on some other existing rate schedule. (3) There is no necessity for the cancellation of a rate schedule under which no customers are being served where the evidence shows that should future customers request service the same rate schedule would have to be refiled.

INVASION OF TERRITORY WHERE AUTHORIZED COMPANY DOES NOT SERVE.—A complaint against the South Jersey Power & Light Company for invasion of territory was made to the New Jersey Board of Public Utility Commissioners by the Atlantic City Electric Company. It developed that the South Jersey company had constructed a transmission line in its rival's territory in a district that the latter was not serving. The commission held that construction of service extensions beyond the limits set by the commission without any regular application for modification of such restriction is unlawful, notwithstanding the fact that the company having authority over such area is unready or unwilling to furnish service. Approval was granted, however, for the completion and operation of the work already started and no further, in view of the expense and loss that would accrue to the utility ratepayers if the equipment had to be removed.

Brief History of the "Electrical World"

The *Electrical World* (published under that name since 1883 and tracing its history back to 1874) is a consolidation of the *Electrical Engineer* (founded in 1882 as the *Electrician*) and the *American Electrician* (founded in 1896). Final consolidation under the title of *Electrical World* took effect on Jan. 1, 1906, the *Electrical World* and the *Electrical Engineer* having been acquired by the McGraw Publishing Company in 1899 and amalgamated as the *Electrical World and Engineer*, and the *American Electrician*, a McGraw monthly, having been absorbed seven years later.

The roster of past editors of the *Electrical World* includes Carl Hering, Louis Bell, W. D. Weaver, T. C. Martin and many other men prominent in the electrical industry—some, like those named, no longer living, and others, like C. O. Mailloux, A. S. McAllister, Frank F. Fowle, F. M. Feiker, D. H. Braymer and H. V. Bozell, still active in engineering and industrial service. William H. Onken, Jr., is now editor and L. W. W. Morrow managing editor. Other members of the present staff are: Earl Whitehorne, commercial editor; Allen M. Perry, associate editor; G. F. Wittig, statistical editor; H. M. Cameron, financial editor; F. C. Wells, news editor; Eustace C. Soares, manufacturing and markets editor; E. R. Searles and E. M. Glennon, assistant editors; F. R. Innes and T. P. Kindig, Western editors; H. S. Knowlton, New England editor; Walter C. Heston, Pacific Coast editor, and Paul Wooton, Washington correspondent.

Recent Court Decisions

ESTIMATING DAMAGE TO MEADOWLAND BY FLOODWATER DUE TO DAM.—J. C. Lynch brought suit against the Minnesota Power & Light Company to recover damage to his meadowland for a period of two years. The damage, it was claimed, was caused by the maintenance of a permanent dam on the Gull River and consisted in the loss of hay crops and in injury to the sod. The Supreme Court of Minnesota upheld the jury's right to determine, on the evidence, that the dam had caused the injury and to assess damages both for the loss of the hay crops and for deterioration in the value of the land. The measure of damage, the court held, was the value of the crops and, in addition, the diminution in the market value of the land so far as it resulted from the flooding complained of. (219 N.W. 459.)*

FISH PRESERVATION AND WATER RIGHTS IN OREGON.—According to the construction of the Oregon laws affecting water rights put forth by the Circuit Court of Hood River County in the case of the State Fish Commission vs. People's West Coast Hydro-Electric Corporation, wherein the plaintiff sought to cancel the utility's water rights on Henry Creek on the ground that the state required the use of the stream for fish propagation purposes, a permit to convert the waters of streams and rivers is absolute when final approval of the application has been signed by the State Engineer and in the creation of a fish reserve does not adversely affect a water right previously approved by the state. This decision apparently renders useless the initiative petition now in circulation to close to industrial development the Rogue, North Umpqua, McKenzie and Deschutes Rivers and establish fish reservations in their waters, since there are, according to the Water Department's records, a number of firms and individuals holding water rights on the four streams in question, whose permits cannot be rendered void unless the Circuit Court's decision be upset.

EXTRAORDINARY AND UNFORESEEABLE ACCIDENT CANNOT BE ASCRIBED TO NEGLIGENCE.—Three boys climbing a steep embankment in a search for berries stepped on a flat stone which tilted under their combined weight, precipitating them against a transformer which was surrounded by a high fence on three sides and by the bank and a ledge of rocks on the other. One boy was killed and another injured, and suit for damages was brought against the company owning the transformer (Koster vs. West Penn Power Company). The Pennsylvania Supreme Court has sustained the trial court in setting aside the jury's verdict for the plaintiff and finding for the defendant company on the ground that there was no negligence shown. The Supreme Court said: "The bank was so rugged and inaccessibly steep that the possibility of anyone climbing up there and falling into the transformer was beyond human foresight. Such an occurrence could not reasonably have been foreseen or guarded against. The trial court was, therefore, clearly right in holding that the failure more securely to protect the transformer was not the proximate cause of the accident." (141 At. 734.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

DAVID W. BEAMAN has been appointed acting manager of the New Bedford (Mass.) Gas & Edison Light Company to succeed W. H. Snow, whose resignation becomes effective July 30.

MERRITT HORNER, formerly illuminating engineer of the Connecticut Light & Power Company, Waterbury, Conn., has resigned to become New England representative of the Holophane Company to succeed James Toohey, who recently relinquished this position.

PROF. W. CLINTON DUVALL of the department of electrical engineering of the University of Colorado, Boulder, has been granted a leave of absence for six months by Dean Herbert S. Evans. Professor Duvall is planing to go to California to join the Southern California Edison Company.

LLOYD N. ROBERTSON, formerly professor of electrical engineering in the College of Mechanics, University of California, Berkeley, and more recently connected with Stone & Webster, Inc., on the Pacific Coast in the capacity of electrical engineer, is now in Japan, where he is engaged in electrical consultation work.

JOHN M. KINKEL, for several years assistant attorney for the Kansas Public Service Commission, has been appointed attorney for that body, succeeding M. J. Healy, who has resigned to engage in private law practice. Mr. Kinkel's connection with the Kansas regulatory body began more than a decade ago when he was made a member of the commission by Governor Hodges. Mr. Healy has served as the commission's attorney since 1925.

W. J. REAGAN, formerly vice-president in charge of commercial activities of the Utica, (N. Y.) Gas & Electric Company, has been appointed vice-president in charge of public relations.

DR. GEORGE FILLMORE SWAIN, professor of civil engineering at Harvard University, was made the recipient of the Benjamin G. Lamme medal for his contribution to the advancement of the art of technical training by the Society for the Promotion of Engineering Education, in session at the University of North Carolina, Chapel Hill. Dr. Swain is the first to receive the medal, which will henceforth be awarded yearly in accordance with provisions in the will of the late Benjamin G. Lamme, according to officials of the society. Betterment of the methods of training young men for the engineering profession was one of the chief passions of Mr. Lamme. As chief engineer of the Westinghouse Electric & Manufacturing Company in an era when the electrical industry was making amazingly rapid progress, Mr. Lamme was one of the central figures in a continuous panorama of revolutionary developments, yet he always found time to teach his method to the youths who flocked to his leadership. It was he who organized the educational department of the Westinghouse company, which is now said to be the most extensive of any industrial corporation.

P. M. Downing New President of Pacific Coast Association

Paul M. Downing, who was elected president of the Pacific Coast Electrical Association at the recent convention held in Pasadena, Cal., has been vice-president of the Pacific Gas & Electric Company in charge of electric construction and operations since early in 1921. Mr. Downing has had long and valuable experience with electric power companies in California, his early professional career including a connection with one of the first hydro-electric installations in that state—the Blue Lakes Water Company. A native of Newark, Mo., he removed to the Pacific Coast and after his preparatory schooling he entered Stanford University with the first class enrolled, Oct. 1, 1891, and was graduated in 1895.

P. M. Downing

Affiliating himself with the Pacific Gas & Electric Company, he became operating engineer and two years later was named engineer of operation and maintenance. Subsequently he was promoted to the position of chief engineer of the electric department in charge of construction, operation and maintenance of all water systems, generating stations, transmission and distribution lines, substations, street railway and steam-heating distribution. Seven years ago he was appointed a vice-president of the company. In addition to being active in the National Electric Light Association, Mr. Downing is a member of the A.I.E.E. and of other engineering societies.

L. A. ZIMA has joined the staff of the Rome Wire Company, division of General Cable Corporation, as district engineer in the New York office. He was formerly cable engineer for the Brooklyn Edison Company in charge of design and specification of cables for power stations, substations and transmission and distribution systems. During his connection with the Brooklyn utility he spent three months in Europe, visiting cable manufacturers in England and on the Continent. Mr. Zima is a member of the American Institute of Electrical Engineers, the Empire State Gas & Electric Association and of the underground system committees of the Metropolitan Section and of the National Engineering Section of the National Electric Light Association.

RALPH H. TEED, formerly of Trinidad, Colo., has been appointed general superintendent of the Citizens Electric Company, Hot Springs, Ark. During the past five years Mr. Teed was executive engineer of the Trinidad Electric Transmission, Railway & Gas Company, which is a property of the Federal Light & Traction Company of New York. He served two years in the New York office of the parent company before removing to Colorado. Mr. Teed is a graduate of Cornell University.

JAMES H. TRISSLER, for fifteen years superintendent of the power distribution department of the Parkersburg & Marietta division of the Monongahela West Penn Public Service Company, has been appointed manager of that division to succeed William M. Martin. Mr. Martin had been connected with the Monongahela West Penn system for a number of years and he resigned to transfer his interests to Albany, N. Y. Mr. Trissler first started with the company at Parkersburg in 1900, and after leaving for a period of three years, in 1909 he returned to the power company and was employed in the power plant, later becoming connected with the distribution department. Mr. Trissler was subsequently appointed superintendent of the distribution department.

HARRY C. WILDER, for the past two years director of sales for the Northeastern Power System, will resign on Aug. 1 to take charge of sales to public utilities throughout the country for the Rome Wire Company, Rome, N. Y., the local plant of the General Cable Corporation. Colonel Wilder has been unusually successful in directing the sales work of the Northeastern Power System. Immediately after establishing headquarters in Rome he organized his sales forces and in two years he has made a record in the increase of sales volume. Before removing to Rome in the spring of 1926 he was president of the Malone Light & Power Company, another link in the Northeastern chain. In addition to having complete charge of all relations with public utility companies for the Rome Wire Company, Colonel Wilder will do special work for the General Cable Corporation. His

headquarters will remain in Rome, but his work will necessitate a considerable amount of traveling.

F. H. ROSENCRANTZ, director of engineering International Combustion Engineering, Ltd., was awarded the Kelvin gold medal of merit by the Institution of Electrical Engineers (British) in recognition of his work in the combustion field.

GEORGE OSBURN, for many years superintendent of the Eastern New York Utilities Corporation, has been appointed manager of that utility.

E. A. V. BROMESON has been appointed superintendent of electrical maintenance of the New York Power & Light Corporation.

FRANK C. KINGSLEY has joined the Illinois Northern Utilities Company, Dixon, Ill., in the capacity of rural service engineer.

LAWRENCE M. DURYEE, formerly service engineer for the South County Public Service Company, Westerly, R. I., has become affiliated with the Connecticut Light & Power Company as power and lighting engineer, with headquarters at Norwalk.

C. T. WHEAT, manager of the Illinois Power & Light Corporation, Carlinville, since 1913, has been appointed district manager of that corporation with headquarters at Hillsboro. L. L. Spears will succeed Mr. Wheat in Carlinville.

G. BERTRAM REGAR, until recently in charge of the lighting service section of the Philadelphia Electric Company, has been promoted to be manager of the lighting sales division, embracing lighting service, commercial lighting, special application, sign lighting, industrial lighting and the incandescent lamp sections.

W. NYE SMITH, new-business manager of the Rome division of the Northern New York Utilities, Inc., has been appointed director of sales for the Northeastern Power System to succeed Col. Harry C. Wilder. Mr. Smith has been connected with the Northeastern Power System for the past five years, resigning as manager of the Mohawk Electrical Supply Company of Syracuse to enter its employ. Before his appointment as new-business manager of the Rome division in charge of all promotional work, he was in charge of similar work in the Watertown division. Mr. Smith is a native of Montpelier, Vt., and early in his career was identified with the publication bureau of the General Electric Company.

PAUL E. SHACKLETT has been appointed assistant manager of the Chattanooga district of the Tennessee Electric Power Company. Mr. Shacklett has been identified with the electric power and light industry for the past 21 years in Nashville and Chattanooga with the Tennessee Electric Power Company and its predecessor companies. His first employment was with the Nashville Railway & Light Company in 1907 in the new-business development department, where he devoted special attention to industrial power engineering and sales work. In 1918 Mr. Shacklett removed to Chattanooga in charge of power sales work, which position he continued to occupy until the present time.

JOSEPH TERRIAULT has been appointed resident manager of the Saratoga district of the New York Power & Light Corporation.

V. M. ROTH, illuminating engineer for 2½ years for Curtis Lighting, Inc., Chicago, has transferred his interests to Dubuque, where he has joined in a similar capacity the Interstate Power Company. He is a graduate of the electrical engineering department of North Dakota University.

C. R. DOWNING, formerly meter superintendent of the Public Service Company of Oklahoma, is now electrical superintendent of that utility in charge of all engineering work pertaining to construction and maintenance of substations.

ROY B. THAYER has been appointed commercial manager of the central division of the Central Maine Power Company, with headquarters at Augusta, embracing the Augusta, Gardiner, Winthrop and Richmond districts. He joined the company in 1918.

E. A. MURRAY, formerly assistant electrical superintendent of the construction division of the Pittsburgh branch, Byllesby Engineering & Management Corporation, has been made superintendent of the meter and tests department of the Duquesne Light Company.

ARNOLD H. HIRSCH has been appointed industrial representative of the power sales division of the Philadelphia Electric Company. Mr. Hirsch will devote his time and efforts to attract new industries to the city of Philadelphia. With this purpose in view the Philadelphia Electric Company will co-operate through Mr. Hirsch with the Chamber of Commerce, the Real Estate Board, the railroads and other civic bodies and organizations.

H. DURANT CHEEVER, president of the Okonite Company, was the guest of honor at a testimonial dinner given at the Engineers' Club, New York, June 27. The occasion commemorated the fiftieth anniversary of the founding of the company and the completion of 40 years of service by Mr. Cheever. One of the features of the evening was an unusually attractive and humorous menu in the form of a buff-colored booklet, containing also testimonials to Mr. Cheever.

JOHN C. FARRINGTON, treasurer of the Middlesex Machine Company, Lowell, Mass., has been elected a member of the board of directors of the Lowell Electric Light Corporation to succeed James C. Reilly, resigned. Mr. Farrington is well known in Lowell and has been actively connected with many civic movements.

H. B. LINGEMAN has been appointed purchasing agent of the Pennsylvania-Ohio Power & Light Company, Pennsylvania Power Company and associated electric and transportation companies of the Penn-Ohio System to fill the vacancy caused by the death of Raymond J. Pike. Mr. Lingeman was formerly supervisor of stores of the Penn-Ohio System, in which capacity he was chief assistant to Mr. Pike, whom he succeeds. During his career in the public utility field he has been affiliated with the Brooklyn Rapid Transit and the Underwriters' Laboratories of New York.

R. H. LIGHTNER of the power sales department of the West Penn Power Company, Pittsburgh, has been appointed sales manager of the Keystone division with headquarters at Ridgway. Mr. Lightner, who has been connected with the West Penn Power Company organization for the past ten years, was born in Washington, Pa. During the past few years Mr. Lightner has been with the power sales department and industrial development department. His wide activity in various departments of the West Penn organization well qualifies him for his new position.

HANS J. MEYER has been appointed engineer in the foreign department of the International Combustion Engineering Corporation. Mr. Meyer has had extensive experience as an engineer and executive. He joined the Combustion Engineering Corporation in 1926 and was placed in charge of design and construction of complete fuel burning and steam generating equipment for the Kip's Bay station of the New York Steam Corporation.

Obituary

FRANK MACGOVERN, organizer and head of Frank MacGovern & Company, Inc., died June 29 after a long illness. About a year and a half ago he was obliged to give up his business in an endeavor to regain his health. Mr. MacGovern, who was one of the oldest dealers in used equipment, was born 59 years ago in the British West Indies, removing to this country at an early age. About 30 years ago he formed the firm of Rossiter, MacGovern & Company, pioneers in the used electrical and steam machinery business, later organizing the company which bore his name. His influence and prestige grew steadily and he was for many years one of the leading machinery dealers of the country.

HERBERT LLOYD, president of the Electric Storage Battery Company, Philadelphia, died July 3, following a long illness. A native of Wales, Mr. Lloyd removed to this country to take graduate work in chemistry. In 1888, when W. W. Gibbs organized the Electric Storage Battery Company, Mr. Lloyd became superintendent and manager of the company, and twenty-two years ago he was named president to succeed Mr. Gibbs, who retired. In addition to being a director of the Electric Storage Battery Company Mr. Lloyd served on the directorate of a number of industrial companies in Philadelphia.

Financial and Statistical News

Stocks Resist High Money Half Year Shows Steady Gain

THE effect of 10 per cent call money in New York for the first time since the fall of 1920 was much smaller than would have been anticipated a week or so ago. While a broad list of prices broke to lower levels, the declines were less in most cases than last week's gains. It was stated that the actual volume of borrowing at 10 per cent was exceedingly small and that brokerage houses were able to secure most of their accommodations much nearer the 7½ per cent rate. Most of the power and light stocks showed losses during the trading session when the 10 per cent rate made its appearance, but in practically all cases they were only marginal.

A survey of the utility markets for the first half year shows a sharp upward trend from the first of January to the middle of May, and heavy liquidation thereafter. The average of a representative group of fifteen stocks of power and light companies shows the following trend by weeks:

January	122	121	124	127	
February	130	130	130	127	
March	128	130	131	134	134
April	136	138	143	142	
May	149	155	157	151	
June	153	142	142	143	144

The liquidation that has taken place was largely during the past six weeks and prices are now at approximately the levels reached at the end of April.

German Utility Company Issues Bonds

First mortgage twenty-year sinking fund 7 per cent gold bonds (closed mortgage) of the Luneburg Power, Light & Waterworks, Ltd., have recently been offered the American investing public at 98 and interest to yield 7.20 per cent. The issue amounted to $1,100,000. The company was organized by the city of Luneburg, Province of Hanover, in 1927 for the purpose of separately operating and owning the electric power, light, gas and water works formerly operated by the city, which owns all the stock of the company. Proceeds of these bonds will be used exclusively for additions to the company's properties and for the extension and betterment of its plants and facilities.

GEOLOGICAL SURVEY REVISES FIGURES.—The United States Geological Survey has called our attention to a typographical error in the figures issued by it for the output in April and published in the June 30 issue of the ELECTRICAL WORLD. The figure should have been 2,940,000,000 kw.-hr. instead of 29,400,000,000.

New England Public Service Issues Report

A substantial gain in revenues for the twelve months ended March 31 last is shown by the report of the New England Public Service Company and its subsidiaries, which are controlled by the National Electric Power Company. Gross operating revenues for the first three months of the current year exceeded those of the same period in 1927

	1928	1927
Gross revenue	$13,748,161	$12,746,178
Net revenue before depreciation	6,920,679	6,122,077

by a substantial margin, which was the case also with net income. The accompanying statistics show the results of operation for the New England Public Service Company properties for the twelve months ended March 31, 1928, against a like period in 1927.

New Light and Power Financing Totals $756,000,000 in 1928

THE month of June contributed the meager sum of $23,107,000 to the amount of new offerings made by the electric light and power companies of the country during the first half of 1928. The decline in new bond issues, which was rapidly increasing toward the close of May, continued without interruption throughout June, with the result that the lowest monthly total recorded since September, 1926, was charged against June.

Last year June showed the same tendency to lag behind the earlier months of the year, but the dearth of new issues did not compare with that of the past month. It so happened that in April and May of the present year substantial issues were floated, the former month closing with a total of $279,535,000 and the latter month with a total of $123,342,000. This accounts for the fact that 1928 has fallen short less than $40,000,000 of last year's record. During the first six months of 1928 new stock, bond and note issues of electric light and power companies totaled $756,390,852, as compared with $795,707,750 for 1927.

Attention is called to the prominent

Security Issues of Electric Service Companies in June

Name of Company	Amount of Issue (Par Value)	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Rockland Light & Power Co.	$4,500,000	30	First refunding mortgage gold bonds, series A	To retire outstanding securities and for other corporate purposes	4½	98½	4.59
United Public Utilities Co.	3,000,000	19	First lien gold bonds, series B	To acquire securities of subsidiaries, to reimburse for capital expenditures and for working capital	5½	97½	5.70
Buffalo, Niagara & Eastern Power Corp.	5,910,000	..	Cumulative first preferred stock	To acquire or retire preferred stocks of subsidiaries	5	98½	5.07
Electric Investors, Inc.	5,047,000	..	Cumulative preferred stock	To provide funds for the retirement of all $7 preferred stock, for the acquisition of additional interests in electric light and power companies and for other corporate purposes	6	103	5.82
Lake Ontario Power Corp.	375,000	29	First mortgage gold bonds	To retire notes and for additions and betterments to the property	5½	101	5.45
	375,000	1	Gold notes		5½	100	5.50
Minnesota Northern Power Co.	500,000	3	Secured gold notes	To acquire controlling interest in utility company and for other corporate purposes	5	98¼	5.50
Suburban Light & Power Co.	1,000,000	20	Gold debenture bonds, series A	To reimburse for additions and extensions to present properties and for other corporate purposes	6	99	6.10
Missouri Power & Light Co.	1,500,000	30	First mortgage gold bonds, series B	To reimburse for property additions	4½	92½	5.00
Public Utilities Consolidated Corp.	600,000	..	Cumulative preferred stock	To acquire utility companies	7	100	7
	300,000	..	Common stock, class A		..	25	....
Total	$23,107,000 (par value)						
Total amount actually realized	$22,678,510						

part taken by refunding operations early in the year, when the public utilities took advantage of low money rates. Toward the end of April and early in May interest rates started to fall, and since that time bankers have been somewhat reluctant to sponsor even refunding issues on a declining market.

WAGNER ELECTRIC CALLS BONDS.—At a meeting of the board of directors of Wagner Electric Corporation held June 22 a resolution was adopted calling for payment on Aug. 1, 1928, certain of the 7 per cent first mortgage serial gold bonds totaling $550,000.

NEBRASKA UTILITY TO ISSUE BONDS.—The Central Power Company of Grand Island, an Insull subsidiary, has asked authority of the Nebraska railway commission to issue $363,600 of bonds to retire $341,000 of floating indebtedness incurred in construction of additions and betterments in recent months. Of the $2,000,000 preferred authorized there is $1,119,000 issued, while common stock outstanding amounts to $2,606,000 and bonds $3,777,500.

English Electric Adjusts Capital

At the annual meeting of shareholders of the English Electric Company of Canada, Ltd., plans were announced for a rearrangement of the capital structure. The plan provides for a reduction of the fixed charges imposed by the present 8 per cent cumulative preferred shares and relief from the obligation of dividend arrears, while placing the senior securities on a stable dividend basis. In commenting on the operations for the past year, the president, R. A. Stinson, said:

"The improvement in the electrical industry continued throughout the period under review and profits of the company were in excess of those of any previous year, which has resulted in a further strengthening of your company's financial position. In our last annual report reference was made to additional lines of manufacture which the company was undertaking in its St. Catharines works, and I am pleased to say that these lines, consisting largely of switchboards, circuit breakers and general switching equipment, for which there is a good and increasing market in Canada, have met with a favorable reception."

KENTUCKY COMPANY RAISES CAPITAL TO $5,250,000.—The capital stock of the Lexington Utilities Company was increased to $5,250,000 by amended articles of incorporation filed recently. The stock is divided into 50,000 preferred shares, with par value of $100, and 250,000 shares of common stock, with $1 par value.

CONSOLIDATED GAS SEEKS COMMISSION'S APPROVAL FOR STOCK EXCHANGE.—The Consolidated Gas Company of New York filed an application with the Public Service Commission last week for permission to issue 1,800,000 no-par common shares and 900,000 no-par $5 cumulative preferred shares which are to be exchanged for 900,000 shares of the capital stock of Brooklyn Edison Company, having a par value of $100. The rate of exchange is two shares of new no-par common stock of the Consolidated company and one share of its

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Monday July 2	Low 1928	High 1928
ABITIBI PWR. & PAPER, com. new—no par	63¼	57	85
Ala. Pwr., $7 cum. pf.—no par	*m* 114	114½	115½
Allis Chalmers Mfg., 6% com.	120	115¼	129¾
Aluminum Co. of Amer., com.	148	120	197¾
Aluminum Co. of Amer., 6% pf.	109	105½	110¼
Amer. & Foreign Pwr. 7% pf.—no par	106¼	104¼	110
Amer. & Foreign Pwr., com.—no par	34½	22¾	38¼
Amer. Bosch Magneto, com.—no par	34½	15¾	41
Amer. Brown Boveri Elec.†	17	10¾	26½
Amer. Brown Boveri Elec., pf. $7	*m*58	40¼	65¼
Amer. Gas & Elec., 6% pf.—no par	*m*104½	104¼	111
Amer. Gas & Elec., com.†—no par	163½	117¾	184
Amer. Lt. & Trac., 6% pf.	118	116	120
Amer. Lt. & Trac., new com.	226	170	249
Amer. Pwr. & Lt., 6% pf.	104½	103¼	107¼
Amer. Pwr. & Lt., com.†—no par	80	62¾	95
Amer. Pub. Serv., 7% pf.	*a*101	97¼	104
Amer. Pub. Serv., com.†	*m* 60	70	75
Amer. Public Utilities, 7% ptc. pf.	*a* 94	93¾	97½
Amer. Public Utilities, 7% pr. pf.	*a* 93½	93¾	103
Amer. Public Utilities, com.	*m* 50	...	...
Amer. States Sec., A	*a* 11	4	13¾
Amer. States Sec., B	*a* 12½	4¼	17¾
Amer. Superpower, 6% 1st pf.	*l* 99	...	...
Amer. Superpower, Class A —no par	37½	33¼	56
Amer. Superpower, Class B†—no par	38	35¼	56¼
Amer. Wtr. Wks. & Elec., 6% pf.	*m*100	101½	106
Amer. W. W. & E., com. new—no par	58	52	70¼
Anaconda Copper cap. $3	68½	53¾	74½
Appalachian Electric Pwr., 7% pf.	109	107	110
Arkansas Pwr. & Lt., 7% pf.	106	108	109½
Assoc. Gas & Elec., $3.50—50	51½	...	...
Assoc. Gas & Elec., pf.—$6—no par	96½	96	98¾
Assoc. G. & E., Class A, 10—no par	48¼	47	52¼
BABCOCK & WILCOX, 7% com.	119	117¾	128
Binghamton L., H. & P., $6 pf.	101	102	109½
Birmingham Elec., pf.—$6—no par	107	104	107
Blackstone Valley G. & E., 6% pf.	*m*105	106	112
Blackstone Valley Gas & Elec., 10% com.—50	*m*165	135	170
Blaw-Knox com.	*i* 105	91	108
Brazilian Trac., Lt. & Pwr., com., new	*f* 58½	...	...
Broad River Pwr., 7% pf.	102	105	108½
Brooklyn Edison, 8% com.	249	206¼	268½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	*i* 26¼	...	...
Buffalo, Niagara & East. Pwr. com. $1.20—no par	*i* 38¼	...	...
CALIFORNIA ELEC. GENERATING, 6% pf.	99	98	101
Carolina Pwr. & Lt., pf.—$7—no par ex. div.	*l*108	109	111
Central & S. W. Util., $7 pf.—no par	*a*102	99¼	105¼
Central & S. W. Util., pr. in. $7 pf.—no par	*a*105½	103¼	112
Central Ark. Ry. & Lt., 7% pf.	105	105	107½
Central Ill. Pub. Serv., $6 pf.	*a* 98½	95	101½
Central Ind. Pwr., 7% pf.	*a* 99	95	101½
Central Maine Power, 6% pf.	97	96	98½
Central Maine Power, 7%	110	109	112
Central Pwr. & Lt., 7% pf.	104	104½	114
Central States Elec., 7% pf.	115	104½	121¾
Cincinnati Gas & Elec., 5% com.	*g*100¼	97¼	100½
Cities Service, $6 pf.—no par	100½	94¼	103½
Cities Service, pf. B—no par	9½	8¾	9¼
Cities Service, pf. BB—no par	95	88¾	97
Cities Service, com.—20	67¾	54	71¾
Cities Service, Bks. Shrs.—10	33¾	26¼	35¼
Cities Service Pwr. & Lt., 7% pf.	108	105½	109
Cities Service Pwr. & Lt., 6% pf.	100½	95½	102
Cleveland Elec. Illg., 6% pf.	110	110	115½
Cleveland Elec. Illg., 10% com.	425	350	425
Columbia Gas & Elec., 6% pf.	106½	106	110¼
Columbia G. & E. com. $5—no par	110½	89¼	118¾
Columbus Elec. & Power, $2 com. no par	*m* 71	66	79¼
Columbus Elec. & Pwr., 7%	110	...	...
Columbus Ry., Pwr. & Lt., 7%	104	107	111
Columbus Ry., Pwr. & Lt., 7% pf. B	103	105	111
Columbus Ry., P. & Lt., com. no par	125	120	125
Commonwealth Edison, 8% com.	*a*184½	165	189
Commonwealth Pwr., 6% pf.	101½	100½	104¼
Commonw'th Pwr., $2, com.—no par	76	62¼	87¼
Conn. Lt. & Pwr., 8% pf.	118	120	123
Conn. Lt. & Pwr., 7% pf.	115	118	121
Cons. Gas of N. Y., pf.	101½	100	105
Cons. Gas of N. Y., com. $5—no par	153½	119¾	170¼
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 6% pf.	*e*110	109¼	114½
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 5% Pf.	*e*102	100	105¾
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, com. $3.00—no par	*e* 79	67½	93
Consolidated Power & Lt., 7% pf.	*m*105	106	109
Consumers Power, 6% pf.	103½	105½	106¼
Consumers Power, 6.6% pf.	103½	106	107
Continental Gas & Elec., 7% pr. pf.	105½	106½	108½
Conti. G. & E. com. $4.40—no par	*m*225	240	265
Crocker Wheeler, com.†	62	...	...
Crocker Wheeler, 7% pf.	96	77	98
DALLAS PWR. & LT., 7% pf	110	110	111½
Dayton Pwr. & Lt., 6% pf.	107	107	110¾
Derby Gas & Elec., 7% pf.	100	96	100½
Detroit Edison, 8% com.	206	166½	209¾
Dubilier Condenser, com.—no par	*m* 3½	2¼	5½
Duke Pwr., cap.	*m*130	130	145
Duquesne Lt., 5% pf.	101½	100½	105½
EASTERN NEW YORK UTIL., $7 pf.	*m*110	111	112½
Eastern States Pwr. B	*m* 18	12	24
Eastern States Pwr., pf.	*m*100½	98	100¾
East. Tex. Elec., 7% pf.	105	106	109
Edison Elec. of Boston, $12 com.	*d*291	252	305
El Paso Elec. 7% pf.	*m*111	110	112½
Elec. Bond & Share, 6% pf.	*l*110	108¾	111¾
Elec. Bd. & Sh. Sec., com. $1—no par	*l*101	76	127¾
Electric Household Util.†	*a* 22½	13¾	27
Elec. Investors, 6% pf.—no par	101	101	104½
Elec. Investors, com.†— no par	63½	40¼	79½
Elec. Pwr. & Lt., ctfs. pf.	107½	106½	110½
Elec. Pwr. & Lt., ctfs., com.—no par	36½	28¾	45½
Elec. Ry. Securities, com.—no par	6¾	...	...
Elec. St. Battery com. $5.25—no par	77½	69	84¾
Elmira Wtr., Lt. & R.R., 7% pf.	105	104	115
Empire Pwr., pfc.†	*m* 35	30	39½
Engr. Pub. Serv. $5, pf.—no par	*m* 96	97	102
Engr. Pub. Serv., com.—no par	38¾	33	46¼
Eureka Vacuum Cleaner, com. $4—no par	66	62¼	79
FAIRBANKS MORSE, 7% pf.	*m*107½	104	114¾
F.-M., com.—$3—no par	*m* 46	32½	54
Federal Lt. & Trac., com. $1.40	52¼	42	56¾
Federal Lt. & Trac., $6 pf.—no par	106	98	109
Florida Pwr. & Lt., 7% pf.	*m*102	105	108
Ft. Worth Pwr. & Lt., 7% pf.	*l*113	113	114½
GALVESTON-HOUSTON ELEC. 6% pf.	80	75	85
Galveston-Houston Elec., com.	33	31¼	34
General Cable, Cl. A	66	56	84½
Gen. Elec. $3 com.—no par	151½	124	174¼
Gen. Elec., special—6%	11¾	11¼	11¾
Gen. Gas & Elec. (Del.), com. A $1.50 no par	47¼	35¼	50¾
Gen. G. & E. (Del.) pf. A. $8—no par	135	125	144
Gen. G. & E. (Del.) pf. A $7—no par	118	110	120
Gen. G. & E. (Del.) pf. B $7	*m*109	104	117
Gen. Pub. Serv., $7 pf.	122½	115	140
Gen. Pub. Serv., com., no par	*m* 23½	16¾	29
General Public Utilities, $7 pf.	*m*130	110	135
Ga. Lt., Pwr. & Rys., com.	*m* 58	55	65
Gt. Western Pwr., 70% pf.	*h*104½	...	...
IDAHO PWR., 7% pf.	109	109	111½
Ill. No. Utilities, 6% pf.	*m* 99	96	100
Ill. Pwr. & Lt., $6 pf.	106½	103	107
Indianapolis Pwr. & Lt., 6½% pf.	*m*104	102	107½
Indianapolis Pwr. & Lt., $7 pf.	101	100	105
Ingersoll Rand com.	*m* 91	90	98
Int. Combus. Engr., com. $2—no par	61½	45½	72¾
Int. Combustion Engr., 7% pf.	103½	103	109
Int. Util., Class A—$3.50—no par	47	44½	52
Int. Utilities, Class B—no par	16½	6¾	19½
Interstate Pwr., pf.—$7—no par	100	99	105
Interstate Pub. Serv., 7% pf.	106	103	108
Iowa Ry. & Lt., 7% pf.	101	102	103
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	103½	106	108
Johns-Manville, com. — no par ex. div.	105½	96¼	134

Stock Exchange: *c*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Tuesday, July 3. *m*Bid price Saturday, June 30. *n*Latest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Monday July 2	Low 1928	High 1928
KANSAS CITY POWER & LIGHT pf. $7	112¼	109	114
Kansas Gas & Elec. 7% pf.	*l*108	107	110
Kelvinator Corp.	15½	11¼	22¾
Kentucky Hydro-Elec., 7% pf.	*m*103	100	105
Kentucky Sec., 6% pf.	90	90	98
Kentucky Sec., 5% com.	150	140	150
Kentucky Utilities, 6% pf.	105	100	105
LACLEDE GAS LT., 10% com.	*m*220	200	260
Lehigh Pwr. Sec., com.—no par	*n* 65	19¼	65
Long Island Ltg., 7% pf.	110	109¼	112½
Long Island Ltg., 6% pf.	*m*103	107	109
Long Island Ltg., com.†—no par	*m*250	170	250
Los Angeles Gas & Elec., 6% pf.	*h*110	105½	112¾
Louisville Gas & Elec., cl. A. $1.75	34½	28	41
MAN. ELEC. SUPPLY, cap. $5— no par	57½	50	66¾
Maytag Co., com. 50—no par	19¾	18½	22
Memphis P. & L., pf.—$7—no par	110	109	111
Metropolitan Ed., pf.—$6—no par	104	103	109½
Metropolitan Ed., pf.—$7—no par	108	109	111¼
Metropolitan Ed., com. $5—no par	*m*170	125	185
Middle West Utilities, 6% cum. pf.	*a* 97½	93¼	100½
Middle West Util., 6% cum. pr lien	*a*101	99	108
Middle West Util., com. $7—no par	*a*146	123½	169
Midland Utilities, pr. ln. 7% pf.	*a* 95	93	107
Midland Utilities, 7% pf. A	*a* 90½	89½	92¾
Milwaukee Elec. Ry. & Lt., 7% pf.	105	100	106
Milwaukee Elec. Ry. & Lt., 6% pf.	100	98	110
Minn. Pwr. & Lt., 7% pf.	*l*107	107	109
Miss. River Pwr., 6% pf.	108	94	112½
Mohawk Hudson Pwr., 1st pf.—$7 —no par	109	107½	110
Mohawk Hudson Pwr., 2d pf.—$7 —no par	*m*102	100	109
Mohawk Hudson Pwr., com.—no par	*m* 41	29½	53
Montana Pwr., 5% com.	*m*147	102½	175
Montreal Pwr., com.$2—no par	*f*107	....	....
Mountain States Pwr., 7% pf.	*m*103	97	105
Mountain States Pwr., com.†	18¼	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	110½
National Carbon, 8% pf.	*a*138	136½	139½
National Elec. Pwr., A†	*a* 33¾	27½	42
National Pwr. & Lt., pf. 7%	109	107½	111
National Pwr. & Lt., com.†—no par	34¼	21¾	36¾
National Pub. Serv., 7% pf.	100	99	104
National Pub. Serv., 7% pfc., pf.	*n*114	....	....
National Pub. Serv., A com. $1.60— no par	27½	22	29¾
National Pub. Serv., B com.—no par	*m* 30	24¼	32¾
Nebraska Pwr., 7% pf.	*l*110	110	111½
Nevada-Calif. Elec., com.	*n* 50	33½	50
New Brunswick Pwr., 4% pf.	60	60	70
New Eng. Pub. Serv., pr. ln. pf. $7	110	98¼	110½
New Eng. Pub. Serv., pf. $7	98	95	108
New Orleans Pub. Serv.—7% pf.	105½	106	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	102	91	104
N. Y. Central Elec., 7% pf.	105	101	107
New York Power & Light 7% pf.	112	....	....
Niagara Falls Pwr., 7% pf.—25	*m* 27½	27½	29½
No. Amer., 6% pf.—50	*m* 54½	53½	55½
No. Amer., com.—10	69½	58¾	78¼
No. Amer. Edison, $6 pf.—no par	101½	100½	105½
Northeastern Pwr., com.	26½	19¾	31
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par	27	18	32
Northern Ohio Pwr. & Lt., 6% pf.	100	90	100
No. Ont. Lt.& Pr. 6% pf.	*m* 98	94	100
No. States Pwr. (Del.), 7% pf.	108½	108½	110½
No. States Pwr. (Del.), 8% com.	135	123	152
No. Texas Elec., 6% pf.	55	45	70
No. Texas Elec., com.	19	....	....
OHIO BRASS, com. B $4—no par.	*k* 92½	90¼	100½
Ohio Brass, 6% pf.	*n*107½	106	108½
Ohio Pwr., 6% pf.	108	104	109½
Ohio Pub. Serv., $6 pf.	104	95	105
Ohio Pub. Serv., 7% pf.	111	107	112
Ohio River Edison, 7% pf.	111	106	109½
Oklahoma Gas & Elec., 7% pf.	109	106	115½
PACIFIC GAS & ELEC., 6% pf.	*m* 26	25½	29
Pacific Gas & Elec., 8% new com.	48	43½	53½
Pacific Pwr. & Lt., 7% pf.	*l*109	106	110
Packard Electric	*n* 66½	47	68½
Penn Cent. Lt. & Pwr., $5 pf.—no par	*c* 78½	78¼	82
Penn-Ohio Edison, 6% pf. no par	95½	92	101
Penn-Ohio Edison, 7% pf.	104½	104½	109
Penn-Ohio Pwr. & Lt., 7% pf.	103	99	112
Penn Pwr. & Lt.—$7—no par	*l*109	109½	110½
Penn Wtr. & Pwr., $2.50 com., new	*e* 77	68	90
Phila. Co., 5% pf.—50	*m* 47	45½	48½
Phila. Co., 6% pf.—50	52½	52	57
Phila. Co., com.—50. ex. div.	160	145	175½
Phila. Elec., 8% com.—25	*c* 67	55½	74¼
Portland Elec. Pwr., 7% pf.	103	100	106
Portland Elec. Pwr., 6% pf.	93	78	96
Portland Elec. Pwr., 6% 2d pf.	83	55	88
Portland Elec. Pwr., com.	43	....	....
Potomac Elec. Power, 6% pf.	*j*111	....	....
Pwr. Sec., pf.—no par	60	50	68
Pwr. Sec., com.—no par	*n* 13½	11¼	14¾
Public Serv. of Colorado, 7% pf.	107	....	....
Pub. Serv. of N. J., 6% pf.	108½	103½	115
Pub. Serv. of N. J., 7% pf.	*m*128½	118	129½
Pub. Serv. of N. J., $2 com.—no par	56½	41½	66¾
Pub. Serv. of No. Ill., 6% pf.	*a*120	110	120
P. S. of No. Ill., com. $8—no par	*a*181½	159½	190½
Pub. Serv. of No. Ill., $8 com.	*n*185	139½	190
Pub. Serv. of Okla., 7% pr. ln.	109	100	107
Pub. Serv. Elec. & Gas, 6% pf.	107½	107½	110½
Puget Sound Pwr. & Lt., 7% pf.	*m*110	105	110
Puget Sound Pwr. & Lt., $6 pf.—no par	101½	84½	105½
Puget Sound Pwr. & Lt., com.	84½	34¼	94½
RADIO CORP. OF AMER., $3.50 pf.—50	56	54½	60
Radio Corp. of Amer., com.—no par	184½	85½	224
Rochester Gas & Elec. 6% pf. D.	105½	105½	106½
Rochester Gas & Elec., 7% pf. B.	107	105	108
Rochester Gas & Elec., 6% pf. C.	104	105½	106½
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	117	110	117½
St. Joseph Ry., L., H. & P., 5% pf.	*m* 75	70	75
Servel, Inc.	14¾	4½	17½
Shawinigan Water & Power.com., $2 no par	*f* 95½	....	....
Sierra Pacific Elec., 2% com.	40	29	40½
Sioux City Gas & Elec., 7% pf.	104	100	108½
Southeastern Pwr. & Lt., pf.—$7 no par	*l*107	....	....
Southeastern Pwr. & Lt., ptc. pf.	*l* 88½	....	....
Southeastern Pwr. & Lt., com.—no par	52½	40¾	61
So. Calif. Edison, 8% pf.	49	38½	53
So. Calif. Edison, 7% pf.	29	27½	29½
So. Calif. Edison, 6% pf.	26½	25½	27½
So. Calif. Edison, 8% com.	48	43½	53½
Southern Cities Utilities, 7% pf.	83	75	92
Southwestern Lt. & Pwr., A $3.	65	60	80
Southwestern Lt. & Pwr., B	50	....	....
Southwestern Lt. & Pwr., $6 pf.	90	88	96½
Southwestern Pwr. & Lt., 7% pf.	*m*111	103	115
Standard Gas & Elec., 8% pf.	68½	65	71½
Standard Gas & Elec., 7% pr. pf.	111½	108	115
Standard G. & E., com. $3.50	65½	57½	74½
Standard Power & Light, com.	49½	29½	58½
Standard Pwr. & Lt., 7% pf.	*m*105	98	106
Staten Island Edison, pf.—$6—no par	98	99	103½
Superheater, $6 com.—no par	150	149½	178
Syracuse Lighting, 7% pf.	110	103	112½
Syracuse Lighting, 8% pf.	*m*120	114	121
TAMPA ELEC., com. $2	*m* 65	62	71
Tenn. Elec. Pwr., 6% pf.	100	92	103
Tenn. Elec. Pwr., 7% pf.	107	107	110
Tex. Pwr. & Lt., 7% pf.	*l*113	113½	115
Tide Water Pwr., 8% pf.	105	108	112
Timken Roller Bear., com.—$4 no par	121	112¾	134
Toledo Edison, 7% pf.	109½	108	111
Toledo Edison, 6% pf.	105	95	105
Toledo Edison, 6% com.	*m*145	120	150
Tri-City Ry. & Lt., 6% pf.	90	88	102
UNITED GAS & ELEC., 7% pf.	95	98	103
United Gas & Elec. (N. J.), 6% pf.	75	70	77
United Gas Impr., 8% com.—50	*c*137½	114½	149½
United Lt. & Pwr., pf.—$4—no par	*m* 55	49	56½
United Lt. & Pwr., pf.—$6.50—no par	101	95	101½
United L. & P., com. A .48—no par	26	13½	26½
United L. & P., com. B .48—no par	28½	20	31
Utah Pwr. & Lt., 7% pf.	*l*106	109½	112
Utica Gas & Elec., 7% pf.	104½	105	106½
Utica Gas & Elec., 8% com.	*m*200	215	225
Utilities Pwr. & Lt., 7% pf.	98	98	104
Utilities Pwr. & Lt., com. A $2	37½	28½	45½
Utilities Pwr. & Lt., com. B $1—no par	29	18½	32½
VERMONT HYDRO-ELEC., 7% pf.	99	95	102
Virginia Elec. & Pwr., 7% pf.	108½	107½	114½
Virginia Public Service 7% pf.	104	97	103½
WAGNER ELEC., 7% pf.	*n*104	96½	107
Wagner Elec., com.—no par	*b* 81½	37	120
Washington Ry. & Elec., 7% com	*j* 450	....	....
Washington Ry. & Elec., 5% pf.	*j* 99½	....	....
Washington Wtr. Pwr., 8% com.	225	175	235
West Penn Elec., 7% pf.	109½	108	115
West Penn Elec., Cl. A $7.	104½	103	112
West Penn Pwr., 7% pf.	116	114¾	118
West Penn Pwr., 6% pf.	106	103	113
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
Western Pwr., 7% pf.	104	98	105
Western States Gas & Elec., 7% pf.	*m*104	100	106
Western States Gas & Elec., com.	*n* 38	....	....
Westinghouse Elec. & Mfg., 8% com. —50	95	88½	112
Weston Elec. Instrument, Cl. A $2 —no par	*m* 32½	30½	40½
Weston Elec. Instrument, com.—no par	23½	12½	28½
Wheeling Elec., 6% pf.	106	95	109
Worthington Pump, 7% pf. A	*m* 49	46½	58½
Worthington Pump, 6% B	*m* 42	41	51
Worthington Pump, com.	31½	28	37½
YALE & TOWNE com. $5—25	*m* 70½	68½	84½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Tuesday, July 3. *m*Bid price Saturday, June 30. *n*Latest quotations available. †Dividend rate variable.

present no-par cumulative preferred stock for each share of the capital stock of the Brooklyn Edison Company. This is the final step in the merger of the two companies.

ABITIBI POWER & PAPER OFFERS LARGE ISSUE. — Recently the Abitibi Power & Paper Company, Ltd., made an offering of first mortgage gold bonds, series A, bearing interest at the rate of 5 per cent, a piece of financing involving a total of $50,000,000. These securities, dated June 1, 1928, and maturing June 1, 1953, were priced at 94½ and interest, to yield 5.40 per cent. The proceeds will be applied in substantial entirety to the retirement of funded debt of the constituent companies with a resultant saving in annual interest charges.

JAPANESE COMPANY TO REDEEM BONDS. — First mortgage 7 per cent sinking fund gold bonds, series A, of the Great Consolidated Electric Power Company, Ltd., of Japan (Daido Denryoku Kabushiki Kaisha) to the amount of $250,000 have been designated by lot for redemption on Aug. 1. The bonds will be payable at 100 and interest.

MOLONEY ELECTRIC FLOATS LOANS.—The Moloney Electric Company, St. Louis, Mo., recently issued 40,000 shares of class A stock at $55 a share, flat. As announced in the June 30 issue of the ELECTRICAL WORLD, the American Brown Boveri Corporation has sold its entire stock holdings in the Moloney organization to Stifel, Nicolaus & Company of St. Louis. Directors of the company have signified their intention of paying dividends at the rate of $4 per annum on the class A stock. The company has also issued fifteen-year 5½ per cent sinking fund gold debentures to the amount of $1,500,000, the price being 97½ and accrued interest to yield about 5.75 per cent.

RECENT LISTINGS ON THE BOSTON EXCHANGE.—There have been placed on the Boston Stock Exchange list temporary certificates for 100,000 shares of $6 cumulative preferred stock of the Central States Electric Corporation. The Boston Stock Exchange has also authorized the listing of temporary certificates for 101,000 shares of Electric Investors, Inc., $6 preferred stock, without par value, with authority to add thereto on notice of issuance in pay-

ment in full 49,000 additional shares, and to place on the list 889,484 shares, without par value, common capital stock of the same company, with authority to add thereto 56,269 additional shares of the same as they may be issued against the subscriptions, and 23,680 additional shares as they may be issued against option warrants.

AMERICAN STATES SECURITIES INCREASES PRICE OF WARRANTS. — The American States Securities Corporation has announced that the $8 subscription price for option warrants entitling stockholders to subscribe for class A common stock expires on June 30. After that date the subscription price will be $12 a share.

Company Reports

Name of Company	Gross Earnings Twelve Months Ended April 30 1928	1927
American Light & Traction & subs*	$37,996,539	$35,587,414
American Power & Light*	70,228,383	67,938,373
American Water Works & Electric & subs.*	49,228,067	46,153,525
Bangor Hydro-Electric	1,893,817	1,778,988
Baton Rouge Electric*	1,046,324	990,087
Baton Rouge Electric	1,048,807	996,786
Blackstone Valley Gas & Electric & subs*	5,973,700	5,607,635
Blackstone Valley Gas & Electric & subs	5,973,513	5,653,261
Carolina Power & Light*	8,964,720	8,457,753
Central Illinois Light	4,511,848	4,289,764
Cape Breton Electric*	660,899	634,038
Cape Breton Electric	660,759	641,525
Central Illinois Pub. Service	13,402,098	13,123,367
Cities Service	32,928,978	28,604,881
Columbus Elec. & Power*	4,346,326	3,867,743
Columbus Electric & Power	4,368,079	3,912,456
ColumbiaGas & Electric*	99,501,712	92,889,384
Commonwealth Power	54,802,502	50,665,794
Consumers Power	27,825,318	25,004,746
Detroit Edison†	18,023,646	16,501,691
East Texas Electric & subs.*	7,375,820	6,020,715
East Texas Electric & subs	7,398,578	6,178,471
Edison Electric Illuminating of Brockton*	1,949,108	1,809,743
Edison Electric Illuminating of Brockton	1,962,370	1,819,005
Electric Power & Light*	53,154,175	50,769,973
Electric Light & Power of Abington & Rockland*	629,384	582,995
Electric Light & Power of Abington & Rockland	631,096	583,651
El Paso Electric & subs.*	3,042,540	2,887,596
El Paso Electric & subs	3,057,700	2,895,487
Federal Light & Traction & subs.*	7,193,610	6,758,019
Fort Worth Power & Light*	3,072,775	2,848,101
Galveston-Houston Electric & subs.*	5,147,911	4,768,972
Galveston-Houston Electric & subs	5,170,956	4,802,534
Idaho Power*	3,279,301	2,893,190
Illinois Power	2,662,675	2,599,944
Interstate Public Service	10,132,679	9,861,786
Kansas City Power & Light	13,140,300	11,154,661
Lake Superior District Pwr.	1,741,191	1,716,256
Milwaukee Elec. Ry. & Lt.*	27,604,736	26,313,010
Montana Power‡	2,524,201	2,458,150
Nebraska Power	4,991,041	4,500,599
Nevada-California Electric	5,275,426	5,028,070
North American*	122,906,742	117,694,137
Ohio Edison	1,972,572	1,851,067
Pacific Power & Light*	3,835,926	3,749,158
Penn.-Ohio Edison & Northern Ohio Power	25,808,844	25,247,514
Portland Electric Power	12,248,511	11,989,367
Public Service of New Hampshire & subs	3,672,210	3,509,492
Puget Sound Power & Light & subs.*	14,934,360	13,876,095
Puget Sound Power & Light & subs	14,952,635	14,036,883
Savannah Electric & Power*	2,238,362	2,245,045
Savannah Electric & Power	2,237,464	2,247,571
Sierra Pacific Elec. & subs.*	1,267,189	1,265,538
Sierra Pacific Elec. & subs.	1,279,925	1,263,180
Southern California Edison*	31,430,850	28,768,090
Southern California Edison	31,841,267	28,908,505
So. Indiana Gas & Electric	3,056,603	2,957,421
Tampa Electric & subs	4,706,508	4,855,288
Tampa Electric & subs	4,697,714	4,852,062
Tennessee Electric Power	12,783,286	12,096,974
Texas Power & Light*	9,440,463	8,306,361
Utah Power & Light*	10,671,176	10,620,263
Virginia Electric & Power & subs*	15,679,692	14,727,607
Virginia Electric & Power & subs	15,707,289	14,847,018
West Penn Electric	37,231,944	35,267,020

* Twelve months ended March 31.
† Four months ended April 30.
‡ Three months ended March 31.

Capital Set-Up Announced for New Rochester Company

The Rochester Empire Power Corporation has been incorporated in Albany with a capital of 200,000 shares of $100 par preferred stock and 1,600,000 shares of no-par common stock as a sequel to the recent purchase of the Mohawk Valley Company and the New York State Railways from the New York Central Railroad by E. L. Phillips and his associates.

The Rochester Gas & Electric Corporation, leading subsidiary of Mohawk Valley Company, together with the New York Central Electric Corporation, the Empire Gas & Electric Company, and the Elmira Water, Light & Railroad Company, subsidiaries of the Empire Power Corporation, which Mr. Phillips has controlled several years, will be consolidated in the Rochester Empire Power Corporation.

According to a letter going to the stockholders of the Mohawk Valley Company, two offers are extended. The stockholders may turn their holdings in to the new company at $75 a share or they may exchange their holdings for stock of the new corporation on the basis of three shares of 6 per cent preferred stock and three shares of no-par value common stock for each five shares held. This exchange offer places a nominal value of $25 a share on the common stock of the new company.

All of the holdings of the Empire Power Corporation in the Empire Gas & Electric Company, the Elmira Water, Light & Railroad Company, the New York Central Electric Corporation and three minor companies, the Marcelius, Jordan and Tracy Development companies, are to be turned over to the Rochester Empire Power Corporation in exchange for 800,000 shares of the common stock of the new company.

The board of directors of the Rochester company will be comprised of Ellis L. Phillips, chairman; George W. Olmsted, president; R. M. Searle, vice-president; Arthur S. Kleeman, vice-president; Nathan Jonas, Walter Kernan and R. F. Van Doorn.

International Paper Becomes Important Power Factor

BECOMING dominantly a public utility enterprise, International Paper & Power Company comes forward to a leading place among the power companies of the United States. The new organization, which is primarily a holding company, upon exchange of its securities for those of International Paper Company and upon purchase of additional stock of New England Power Association, will bring into one group properties whose securities have a combined market value of over $550,000,000. More than half of this represents segregated power and utility properties. The balance represents timber, pulp, paper and other miscellaneous properties, along with power properties not yet segregated.

Under the new plan, which will shortly be voted on by stockholders, capitalization of the International Paper & Power Company will consist of 1,000,000 shares of $100 par 7 per cent preferred stock, 20,000 shares of $100 par 6 per cent preferred stock, 5,000,000 no-par class A, 3,000,000 no-par class B and 3,000,000 no-par class C common shares. Holders of class A stock will receive annual dividends of $2.40 a share and will have preference over the other two classes of stock for a limited period, after which all of the new stock will be of a single class.

ACQUIRES CONTROL OF NEW ENGLAND POWER ASSOCIATION

One of the first operations of the new organization, which incidentally will be a Massachusetts trust, will be to purchase for cash all of the New England Hydro-Electric Company's holdings in the New England Power Association. As this amounts to 46 per cent of the outstanding stock, and the International Paper Company now holds 45 per cent, the new company will own 91 per cent of the Massachusetts utility's common stock.

The New England Hydro-Electric Company was formed as a temporary unit for the purpose of holding a block of New England Power Association shares acquired by John R. Macomber and associates.

ILLINOIS UTILITY DECLARES INITIAL DIVIDEND.—The Illinois Power & Light Company declared an initial quarterly dividend of $1.50 on the cumulative $6 preferred stock, no par value, payable Aug. 1 to holders of record July 14.

AMERICAN & FOREIGN POWER PAYS INITIAL DIVIDEND.—The directors of the American & Foreign Power Company have declared an initial cash dividend of $1.75 per share on the second preferred stock, series A (for the quarter ended Dec. 31, 1927), payable Aug. 1 to holders of record July 14.

PUBLIC SERVICE CORPORATION OFFERS RIGHTS.—The right to subscribe to an issue of $5 preferred stock at 98 in the ratio of one new share for each twenty shares held has just been extended to preferred and common stock holders of the Public Service Corporation of New Jersey of record July 6. The subscription price is payable Aug. 31 together with accrued dividends to be calculated from June 30. Subscribers may pay for stock in ten monthly installments, the first of $8 on Aug. 31. Approximately 285,887 shares of $5 preferred stock will be issued under this plan.

Business News and Market Conditions

Canada Considers Import Duty on Copper Rod

The first hearing by the Canadian Advisory Board on Tariff and Taxation of the application of the Eugene Phillips Electrical Works of Brockville and Montreal for the imposition of an import duty of ½ cent per pound on copper rods used for the manufacture of electrical conductors took place in Ottawa on June 20. The case gives every indication of assuming an international aspect and is likely to lead to negotiations between the Canadian and the United States governments with a view to remedying an unusual situation, which was described as the reverse of dumping.

The Consolidated Mining & Smelting Company of Trail, British Columbia, is the only Canadian refiner of copper into copper bars. About 67 per cent of all copper refined at Trail is made into copper bars and the total output of copper bars from Trail is taken by the Eugene F. Phillips Company for its Brockville rolling mill. The copper bars purchased from the Trail plant constitute 65 per cent of the copper bar requirements of the Phillips company and the remaining 35 per cent is purchased in the United States. The Phillips company is the only company in Canada operating a plant for rolling copper rods, but is in competition in the manufacture of copper cables and wires with four Canadian manufacturers of wire and cable. All of these companies, under the existing customs tariff, are able to import their copper rods from the United States free of duty.

Value and Destination of Electrical Exports for April, 1928, Compared with Corresponding Month in 1927

(Issued by Bureau of Foreign and Domestic Commerce)

Article	April 1927	April 1928
Generators:		
Direct-current:		
Under 500 kw.	$126,851	$88,532
500 kw. and over	.....	31,486
Alternating current:		
Under 2,000 kva.	33,139	8,033
2,000 kva. and over	21,630	.....
Steam turbine generator sets	85,172	72,710
Accessories and parts for generators	70,841	68,953
Self-contained lighting outfits	111,148	65,890
Batteries:		
Flashlight batteries	193,235	222,182
Other dry and wet cell primary batteries	246,515	292,418
Storage batteries	362,445	344,485
Transforming or converting apparatus:		
Power transformers	84,002	*
Power transformers, 500 kva. and over	*	17,342
Distributing transformers, under 500 kva.	*	101,876
Other transformers	110,727	*
Instrument transformers	*	22,725
Other transformers, not elsewhere stated	*	56,264
Battery chargers under 15 amp.	*	9,818
Rectifiers, double current and motor generators, dynamotors, synchronous and other converters	75,253	171,467
Transmission and distribution apparatus:		
Switchboard panels, except telephone	81,829	264,349
Switches and circuit breakers over 10 amp.	151,816	111,190
Fuses and fuse blocks	28,719	30,358
Watt-hour and other measuring meters	41,774	123,608
Volt, watt, and ampere meters, and other recording, indicating, and testing apparatus	157,141	*
Electrical indicating instruments	*	29,169
Electrical recording instruments	*	24,850
Other electrical testing apparatus	*	54,266
Lightning arresters, choke coils, reactors, and other protective devices	40,308	54,962
Motors, starters and controllers:		
Motors, under 1 hp.	$243,098	*
Motors ¼ hp. and under	*	$5169,493
Motors over ¼ hp and under 1 hp.	*	95,279
Stationary motors:		
1 to 200 hp.	400,683	219,144
Over 200 hp.	16,638	18,286
Railway motors	86,262	30,377
Electric locomotives:		
Railway	259,771	40,505
Mining and industrial	52,714	20,859
Station and warehouse electric motor trucks	19,916	15,686
Starting and controlling equipment:		
For industrial motors	91,792	116,485
For electric railway and vehicle motors	3,660	5,486
Portable electric tools	58,503	120,848
Accessories and parts for motors	186,161	174,731
Electric appliances:		
Electric fans	115,469	63,835
Electric lamps:		
Metal filament	114,353	154,768
Other electric lamps	35,219	28,462
Flashlights	222,987	229,343
Searchlights and projectors	108,096	52,825
Motor-driven household devices	240,816	*
Electric vacuum cleaners	*	106,509
Other motor-driven devices except tools	*	73,279
Electric flatirons	*	27,015
Domestic heating and cooking devices	141,378	*
Electric cooking ranges	*	26,779
Other domestic heating and cooking devices	*	68,689
Industrial electric furnaces and ovens	29,038	20,420
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc	147,666	165,396
Signal and communication devices:		
Radio apparatus:		
Transmitting sets and parts	38,379	69,664
Receiving sets	211,029	227,653
Tubes	78,998	80,916
Receiving-set components	175,261	165,168
Receiving-set accessories	160,927	168,583
Telegraph apparatus	$60,847	$82,133
Telephone apparatus:		
Telephone instruments	26,311	24,357
Telephone switchboards	120,451	9,757
Other telephone equipment	236,214	183,931
Railway signals, switches and attachments	59,836	59,167
Bells, buzzers, annunciators and alarms	37,813	68,148
Other electric apparatus:		
Spark plugs, magnetos, and other ignition apparatus	169,801	*
Spark plugs	*	96,151
Other starting, lighting, and ignition equipment	*	106,838
Insulating material	152,190	77,957
Metal conduit, outlet, and switch boxes	87,819	104,056
Sockets, receptacles and lighting switches	151,508	147,553
Electric lighting fixtures, interior and street	158,226	*
Electric interior lighting fixtures	*	160,207
Electric street lighting fixtures	*	22,104
Other wiring supplies and line material	135,238	72,818
Other electrical apparatus, not elsewhere stated	693,518	580,375
Rubber and friction tape	43,134	36,714
Globes and shades for lighting fixtures	51,157	59,722
Electrical glassware except for lighting	14,117	56,548
Electrical porcelain:		
For less than 6,600 volts	59,874	40,343
For 6,600 volts and over	69,986	59,349
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	159,013	245,038
Other carbon products	103,154	51,577
Insulated wire and cable (iron or steel)	11,127	9,959
Copper, bare wire	139,406	220,052
Copper, insulated wire and cable	461,543	277,119
Refrigeration sets up to 1 ton capacity	252,073	593,220
Domestic washing machines	129,994	138,300
Totals	$8,845,709	$8,606,909

*Changes in classification make no comparative data available.

DESTINATION OF ELECTRICAL EXPORTS

Country of Destination	April, 1928
EUROPE:	$1,712,005
Belgium	84,461
France	148,578
Germany	104,199
Italy	99,342
Netherlands	104,676
Spain	277,999
Sweden	53,515
United Kingdom	543,251
Other countries	295,984
WESTERN HEMISPHERE:	$5,112,068
Canada	2,427,200
Mexico	406,896
Cuba	264,983
Argentina	679,102
Brazil	399,922
Chile	99,411
Colombia	162,824
Peru	35,836
Venezuela	105,078
Other countries	530,816
ASIA, AFRICA AND OCEANIA:	$1,782,836
British India	195,364
China	127,588
Japan	237,078
Philippine Islands	133,342
Australia	522,112
New Zealand	138,595
Union of South Africa	158,902
Other countries	269,855

Market Conditions

ACTIVE industrial business is noted throughout the country and inquiries are in good volume. Industrial plant building is at a high rate and bids fair to continue. The prospects for the second half of 1928 are excellent. Automobile manufacturers are prominent buyers. One company is buying motors for a Missouri plant to cost more than $1,000,000, another for additions to its Pontiac plant to cost $1,300,000 and a Wisconsin manufacturer plans a new unit to cost $500,000. Other important industrial expenditures planned include $200,000 worth of electrical equipment for a paper bag plant in Washington, a British Columbia paper mill to cost $400,000, a steel plant extension in Ohio to cost $500,000 and chemical plants of one company in New Jersey and Canada to cost $2,000,000.

In New England motor sales have advanced and orders for larger units are more numerous. The demand for industrial electric heating furnaces is outstanding. Industrial business is active in the Eastern district, and central-station companies are buying transmission cable. An order for two 70,000-sq.-ft. condensers placed in the Southeast amounted to $300,000. A New Orleans company also bought $20,000 worth of distribution transformers. The electric refrigerator sales campaign of one power company resulted in $630,000 worth of orders in two months.

Business is more favorable in the St. Louis district, and second quarter sales have improved in the Middle West. On the Pacific Coast June business was good. Encouraging prospective business includes $100,000 worth of transformers and synchronous condensers for the San Joaquin Light & Power Corporation and $500,000 worth of transformers for the Southern California Edison Company. The Great Western Power station in San Francisco is expected to require much equipment and nearly $1,000,000 will be spent by the Modesto irrigation district.

Metal Markets Quiet—Sales Below Normal

The metal markets have quieted down considerably with sales of all the more important metals well below the normal weekly average. Prices have not been affected adversely. Almost three-quarters of the copper sold was for July shipment, but there is not any great amount of prompt metal available nor is the demand for early shipment acute. The tonnage sold has been the lowest for more than two months, few buyers other than those who have found themselves a little short of current requirements having been in the market.

NEW YORK METAL MARKET PRICES

	June 27, 1928 Cents per Pound	July 3, 1928 Cents per Pound
Copper electrolytic	14.525	14.525
Lead, Am. S. & R. price	6.30	6.30
Antimony	9¼	9¼
Nickel, ingot	35	35
Zinc spots	6.55	6.55
Tin, Straits	47	46.125
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price July 3, 1928, 16¼ cents.

Industrial Business Active in Eastern District

Industrial electrical equipment continues in good demand in the Eastern district and inquiries presage a continuance. Automobile manufacturers are prominent in the call for motors and kindred equipment. A company which plans an assembling plant in Missouri to cost more than $1,000,000 has been inquiring for motors for punch press service, a manufacturer of popular-priced cars at Pontiac, Mich., will make additions to cost close to $1,300,000 and is expected to issue a list of requirements at an early date and a motor car producer in Wisconsin is projecting a new unit to cost about $500,000. Paper mills, chemical plants and metal-working factories are making sizable commitments and future business looks strong from these branches of the trade. A paper bag company at New York has been in the market for switchboard and other apparatus for a proposed plant in Washington to cost about $200,000, and another mill in Northern New York has placed a contract with a leading maker for similar equipment to cost $40,000. A paper manufacturer in Oregon is arranging an expansion program for a mill in British Columbia, to cost in excess of $400,000. A steel manufacturer in Ohio will carry out extensions to cost close to $500,000. A chemical manufacturer at New York is planning an expenditure of more than $2,000,000, at plants in New Jersey and Canada.

Central-station companies are developing an increased demand for cables for transmission service and the situation in this branch of the industry shows improvement. A New York utility has made a commitment for paper cable totaling about $160,000. A central station in New Jersey is expected to place orders for cable for transmission service at an early date. The demand for prime movers for central-station installation is at a low ebb, while substation equipment, also, shows the usual tendency to lag at this time of year. A central station in Ohio is projecting plans for extensions in power plant and transmission system to cost approximately $1,000,000. Ice plants have been prominent in the demand for apparatus, while baking plants have shown excellent commitments, a Brooklyn plant of this character having placed an order in connection with a change in service from direct to alternating current. Immediate construction operations in the Eastern district include the following:

The American Cyanamid Company, New York, plans a plant at Linden, N. J., and mill improvements at Warners, N. Y., and Niagara Falls, Ont., to cost $2,000,000. The Firth Carpet Company, Firthcliffe, N. Y., plans a mill to cost $130,000. The Clyde Steamship Company, New York, plans a cold storage plant at Miami, Fla., to cost $60,000. The Tidewater Oil Company, New York, has purchased property at Baltimore, Md., for a distributing plant to cost $400,000. Parsons, Klapp, Brinckerhoff & Douglas, New York, engineers, are preparing plans for a cold storage terminal for the Tampa Union Terminal Company, Tampa, Fla., to cost $650,000. Perin & Marshall, New York, engineers, plan a manganese mining project for the Georgia Manganese & Iron Company at Cartersville, Ga., to cost $1,000,000. The Union Bag & Paper Company, New York, plans a mill at Vancouver, Wash., to cost $200,000. The Carborundum Company, Niagara Falls, N. Y., plans an addition to cost $90,000.

The Pennsylvania Salt Manufacturing Company, Philadelphia, Pa., will build a plant for a subsidiary, the Tacoma Electrochemical Company, at Tacoma, Wash., to cost $100,000. Margolin & Baten, Paterson, N. J., plan an addition to their silk mill at Athens, Pa., to cost $85,000. The Delaware River Steel Company, Chester, Pa., plans enlargements in its bolt and nut mill at Scranton, Pa., to cost $75,000.

Motor Sales Advance in New England

Motor sales in the New England district have been quite active. One manufacturer records an order for a lot amounting to over $20,000 and another reports a gradual increase in the demand and a weekly showing totaling above $40,000. Orders for large power units are more numerous, with 75 to 100-hp. sizes receiving attention. Contractors have placed orders for several of the larger sizes for rock crushers and a number of deliveries to laundries is noted. Manufacturers are interested in fractional sizes and one candy machine manufacturer recently placed an interesting order. Transformer sales are pending, with a number of orders, estimated by one prominent representative at about $65,000, are soon to be scheduled for plants in northern New England.

Industrial electric heating furnaces are an outstanding feature in the specialty market. According to a prominent manufacturer, the demand at this time is unexpectedly favorable. Electric floodlighting systems are being considered for new buildings, one for 100 kw. being of interest. Street traffic control signals also are in strong favor. A recent report from an authoritative source draws an encouraging picture of increased activity throughout industrial centers in Maine. Quotations on electrical supplies are being asked in good volume. Jobbing is rather spotty. New projects are as follows:

A new electric power plant for the A. D. Windle Company, Milbury, Mass., to cost about $50.000. The Grafton Power Company will construct two hydro-electric plants on Fifteen-Mile Falls, N. H., to

develop ultimately about 200,000 kw. at an estimated cost of $40,000,000. The Central Maine Power Company will construct a hydro-electric plant on the Kennebec River, near Bingham, Maine, to develop 40,000 hp., costing $7,000,000. The Fafnir Bearing Company, New Britain, Conn., plans an addition, to cost $125,000.

Business More Favorable in St. Louis District

Conditions in the St. Louis district are slightly more favorabe. A street lighting contract amounting to $20,000 was let in the southwestern section, a switchboard for the western part of the district was ordered at a cost of $16,000 and an order for industrial substation equipment amounted to $3,600. Small orders are being placed in better volume and inquiries seem to be more substantial. Line construction material orders have increased and fans and refrigerators are selling well. Construction projects are as follows:

The Houston Oil Company, Houston, Tex., plans an expansion in its refinery at Camden, Ark., to cost $100,000. The International Shoe Company, St. Louis, will build a textile mill at Malvern, Ark., to cost $800,000. The Atchison, Topeka & Santa Fe Railway Company, Topeka, Kan., plans a coaling station at Great Bend, Kan., to cost $100,000. The Supervising Architect, Washington, D. C., will receive bids until July 19 for an engine-generator set and auxiliary equipment for the National Home for Lepers, Carville, La. The Kansas City Power & Light Company, Kansas City, Mo., plans an underground conduit system. The Spartan Aircraft Company, Tulsa, Okla., plans a plant to cost $300,000.

The Texas Corporation, Houston, Tex., plans a pipe line, about 470 miles long, to cost $10,000,000. The Houston Lighting & Power Company, Houston, Tex., plans a substation at Pasadena, Tex., to cost $80,000. The Central Power & Light Company, San Antonio, Tex., plans a hydro-electric plant on the Devils River, Val Verde County, and will add a 10,000-kw. unit to its steam plant at San Benito, Tex. The Texas Citrus Fruit Exchange, San Benito, Tex., plans a packing plant, to cost $100,000. The Sealy Mattress Company, Sugarland, Tex., plans a plant at Houston, Tex., to cost $130,000. Fort Worth, Tex., plans an ornamental lighting system.

Second Quarter Sales Better in Middle West

It is believed in the Middle West that final reports of business for the second quarter of the year will show a substantial increase over that of the first quarter and will be up to expectations indicated at the beginning of the year. With the exception of a few industries and some agricultural districts, the Middle West is in good shape and the feeling of confidence is becoming stronger. Utility companies are contributing largely to general business by continued expansion. Construction projects are as follows:

The Mills Novelty Company, Chicago, plans an addition to its vending machine plant, to cost $175,000. The Public Service Company of Illinois, Chicago, plans a distributing plant at Harvey, Ill., to cost $100,000. The Warner Gear Company, Muncie, Ind., plans additions to cost $125,000. The Eastern Iowa Power Company, Cedar Rapids, Iowa, will soon take bids for a hydro-electric plant on the Maquoketa River, near Canton, Iowa. The Terminal Grain Corporation, Sioux City, Iowa, will soon take bids for an addition to cost $100,000. The John Deere Tractor Company, Waterloo, Iowa, will make additions to cost $400,000. The Oakland Motor Car Company, Pontiac, Mich., plans additions to cost $1,000,000.

The Otis Steel Company, Cleveland, plans additions at its Riverside works, to cost $500,000. The Grasselli Chemical Company, Cleveland, plans improvements at different mills, to cost $500,000. The Department of Public Welfare, Columbus, Ohio, will receive bids until July 11, for a power plant at the Institution of Feeble-Minded. Dayton, Ohio, plans a central-station for fire alarm, telegraph and police signal system, to cost $50,000. The Toledo Edison Company, Toledo, Ohio, plans an addition to its power plant and will build a 132,000-volt transmission line to Sandusky, Ohio, to cost $1,000,000. The Empire Floor & Wall Tile Company, Zanesville, Ohio, plans a plant to cost $150,000. The Waukesha Motor Company, Waukesha, Wis., plans additions to cost $500,000. Niles Center, Ill., St. Paul, Minn., and Madison and Neenah, Wis., plan ornamental lighting systems.

Large Condenser Order Placed in Southeast

The outstanding order placed in the Southeast was by a Carolina power company for two 70,000-sq.ft. surface condensers approximating $300,000. A central-station company in the New Orleans territory ordered distribution transformers amounting to $20,000, while a company in the eastern section of the Southeast ordered similar equipment to the extent of $10,000.

Sales of merchandise stocks are excellent as a result of the aggressive efforts of central-station companies. One power company has just completed a two-month electric refrigerator sales campaign in which the sales total exceeded $630,000. A construction contract has been awarded on a new tobacco plant in the Carolinas and electrical materials and apparatus for this plant will approximate $50,000. Two cotton mills in Georgia placed orders for wiring supplies amounting to $2,500 each. Construction projects are as follows:

The Gulf States Steel Company, Alabama City, Ala., will make expansions to cost $2,000,000. Glennville, Ga., will make extensions in its municipal electric and pumping plant, to cost $24,000. Swift & Company, Chicago, will build a cold storage unit at its meat-packing plant at Moultrie, Ga., to cost $100,000. The Mississippi Power Company, Gulfport, Miss., will build a substation at Aberdeen, Miss. The Joanna Cotton Mills, Goldville, S.C., will build a unit, to cost $1,000,000.

The Atlantic Ice & Coal Company, Atlanta, Ga., plans a cold storage plant at Knoxville, Tenn., to cost $100,000. The Standard Sanitary Manufacturing Company, Pittsburgh, Pa., plans a factory at Nashville, Tenn., to cost $100,000. G. S. Howe, East Radford, Va., heads a company which plans a hydro-electric plant on the New River. The Appalachian Electric Power Company, Roanoke, Va., will make extensions in transmission lines in Montgomery and Roanoke counties. Daytona Beach, Fla., and The Mutual Light & Water Company, Brunswick, Ga., plan ornamental lighting systems.

June Business Good on Pacific Coast

June business was reported good by all electrical branches on the Pacific Coast except manufacturers of electrical machinery, but they are encouraged by prospective business. Such business includes $100,000 worth of transformers and synchronous condensers for the San Joaquin Light & Power Corporation, $500,000 worth of transformers for various stations of the Southern California Edison Company and much of the equipment for the Great Western Power steam station now being constructed in San Francisco. The proposed Tiger Creek plant of the Pacific Gas & Electric Company will probably be figured in the late fall for 1929 installation. It is also expected that nearly $1,000,000 will be spent by the Modesto irrigation district for additions and alterations to its 60-kva. system.

A contract has been let to the Westinghouse Electric & Manufacturing Company for machinery for the third unit of the Gorge Creek plant of the Skagit project by Seattle. This project will cost about $400,000. The municipal lighting department of Seattle bought over $95,000 worth of manila rope and insulated lead cable, about $4,000 worth of rubber-covered wire and other material and also called for bids for 150,000 lb. of weatherproof wire and for constructing a lighting system in West Seattle to cost $115,000. The volume of motors sold to irrigation and orchard districts and for cold storage warehouses is reported good. June building in Seattle broke all existing records for any 30-day period in the history of the city and exceeded $6,000,000. Construction projects are as follows:

The Pacific Coast Steel Company plans an addition at South San Francisco, Calif., to cost $500,000. The Watsonville Ice & Cold Storage Company, Watsonville, Calif., will make extensions in the power house at its ice plant, to cost $75,000. The Idaho Power Company, Twin Falls, Idaho, plans a substation to cost $50,000. The Northern Pacific Railroad Company, St. Paul, Minn., plans a steel car shop at Laurel, Mont., to cost $180,000. The Vancouver Kraft Company, Ltd., care of F. W. Leadbetter, Salem, Ore., plans extensions at Port Mellon, B. C., Can., to cost $400,000.

The Quartermaster Corps, Fort Worden, Wash., will receive bids until July 19, for a heavy duty, Diesel-type marine engine (Circular 22). The Port Commission, Seattle, Wash., plans a grain elevator, to cost $900,000. The Richfield Oil Company, Seattle, Wash., plans an oil distributing plant on West Garfield Street, to cost $90,000. The United States Gypsum Company, Chicago, will make extensions at Laramie, Wyo., to cost $100,000. Los Angeles, Hanford, South Gate, Coronado, San Jose, Monrovia, and Bakersfield, Calif., and Great Falls, Mont., plan ornamental lighting systems.

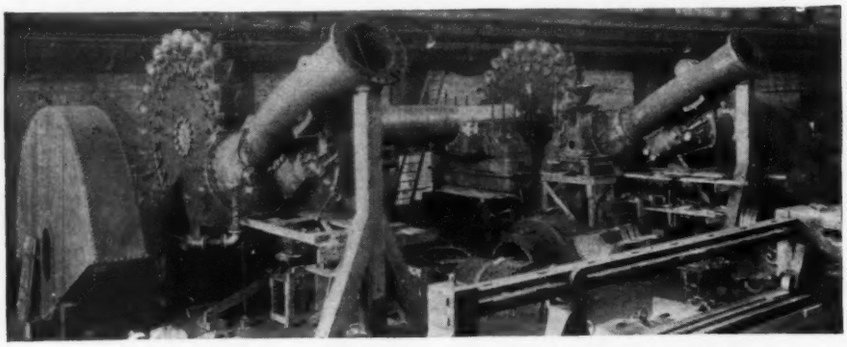
Activities of the Trade

Beaver Machine & Tool Changes Name

The Beaver Machine & Tool Company, Inc., Newark, N. J., announces a change in its corporate name to the Beaver Manufacturing Company. The general corporate name dates back to the pre-war days and since 1919, the company states, the old name has been misleading. The change of name involves no change in ownership or policies as the company will continue to manufacture its line of wiring devices under the trade name of Beaver. The company also announces the appointment of the Otto E. Heilmann Company, St. Louis, as its sales representative for the St. Louis territory to succeed Franklin McDermott.

Large Hydraulic Turbine for Southern California Edison

The 56,000-hp. hydraulic turbine for the Big Creek 2-A plant of the Southern California Edison Company being built by the Allis-Chalmers Manufacturing Company of Milwaukee is shown in the accompanying illustration. The total weight and hydraulic load on each main bearing is 340,000 lb. and the maximum impact of each jet may attain 100 tons. The velocity of each jet is 376 ft. per second, or 256 miles per hour. The buckets weigh approximately 900 lb. each, and at runaway speed their bolted connection has to withstand a centrifugal force of 485,000 lb.



Assembled 56,000-hp., 2,200-ft. head, 250-r.p.m. double overhung impulse turbine with bearing caps and housings removed

Groundulet Company Now Borden Electric Company

The Groundulet Company of Newark, N. J., which was organized for the purpose of marketing grounding fittings of various types, announces a change in name to the Borden Electric Company. Among other things, the company developed the Groundulet system of safety circuits for use in connection with the grounding of secondaries on the customer's premises. The business being primarily a conduit fitting business, the company disposed of its interest in this particular type of equipment, including the trade names "Groundulet" and "Groundit," to the Crouse-Hinds Company, Syracuse, N. Y. The company is now devoted to the development of power grounding equipment and ground testing meters and has changed its name in order to avoid any confusion with the trade name "Groundulet."

Westinghouse Jobbers Elect Officers

At the meeting of the Westinghouse Agent-Jobbers' Association held recently, the following officers were elected for the next year. President, Walter Williamson, vice-president and general manager Alpha Electric Company, New York; vice-president, J. S. Tritle, general manager merchandising department, Westinghouse Electric & Manufacturing Company, Mansfield, Ohio; secretary, H. M. Gansman, vice-president and general manager H. C. Roberts Electric Supply Company, Philadelphia; assistant secretary and treasurer, H. T. Pritchard, office manager merchandising department, Westinghouse company, Mansfield, Ohio.

The members of the executive committee are as follows: W. I. Bickford, secretary-treasurer Iron City Electric Company, Pittsburgh; W. W. French, vice-president and general manager Moore-Handley Hardware Company, Birmingham, Ala.; Karr Parker, treasurer McCarthy Brothers & Ford, Buffalo, N. Y.; J. C. Schmidtbauer, vice-president Julius Andrae & Sons Company, Milwaukee; B. E. Finucane, general manager Rochester Electrical Supply Company, Rochester, N. Y.; A. E. Allen, vice-president Westinghouse Lamp Company, New York; N. G. Symonds, Northwestern district manager Westinghouse company, Chicago; M. C. Morrow, sales manager merchandising department, Westinghouse company, Mansfield, Ohio; T. J. Pace, director of sales Westinghouse company, East Pittsburgh, Pa.; C. E. Stephens, Northeastern district manager Westinghouse company, New York, and S. A. Chase, special representative merchandising department, Westinghouse company, Mansfield, Ohio.

Original Owners Acquire Moloney Electric

Control of the Moloney Electric Company of St. Louis, the sale of which was approved by the American Brown Boveri Electric Corporation as announced in the ELECTRICAL WORLD last week, has reverted to the company's founders, T. O. Moloney and James J. Mullen, according to an announcement by Stifel, Nicolaus & Company, brokers, to whom the sale was made. Mr. Moloney will be president of the company, which was organized by himself and Mr. Mullen 31 years ago. The sale also involves the consolidation of the Moloney Electric Company with the Moloney Realty Company.

The capitalization of the Moloney company will consist of a total of $1,500,000 worth of fifteen-year 5½ per cent debenture bonds, 40,000 shares of class A stock and 40,000 shares of class B stock. The company recently moved into a new factory at 5390 Kingshighway Northwest, but it retains its old factory as a branch.

THE PACKARD ELECTRIC COMPANY, Warren, Ohio, manufacturer of transformers and automotive cables, announces the opening of an office at 1006 Washington Avenue, Houston, Tex. This office will be in charge of John A. Coleman, whose territory will include the entire State of Texas.

THE OLIVER IRON & STEEL CORPORATION, Pittsburgh, announces the opening of a warehouse at Nineteenth and Campbell Streets, Kansas City, Mo., W. M. Watters, district manager of the Oliver corporation and formerly at 209 Baltimore Building, has moved his offices to the warehouse building, where he will be in charge.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received orders totaling more than $1,000,000 from two large power companies. The Alabama Power Company has ordered two 29,000-kva. generators for its lower Tallassee hydro-electric development in Elmore County, Ala., and the Lexington Water Power Company has ordered four 40,625-kva. generators for its Saluda River development near Columbia, S. C.

THE IROQUOIS ELECTRIC REFRIGERATION COMPANY, 1600 Arch Street, Philadelphia, announces the appointment of Walter F. Worrell as manager of sales. Mr. Worrell formerly was special representative for the company in the Chicago territory.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 12, 1928)

1,672,894. OSCILLOGRAPH; J. W. Legg, Wilkinsburg, Pa. App. filed Sept. 8, 1920. Portable.

1,672,897. STARTING CONNECTION FOR ALTERNATING MOTORS; E. Mayer, Berlin, Germany. App. filed Jan. 9, 1924.

1,672,899. ELECTROLYTIC CONDENSER AND ELECTROLYTE THEREFOR; H. N. Miller, Chicago, Ill. App. filed March 5, 1927.

1,672,915. CONNECTION PLATE FOR TOY ELECTRIC RAILWAYS; W. Schwarzenhauer, Eltersdorf, Germany. App. filed Aug. 2, 1926.

1,672,942. ELECTRIC WATER HEATER; M. Isaacs, Minneapolis, Minn. App. filed Jan. 17, 1927.

1,672,967. ELECTRICAL TRANSLATING DEVICE; S. S. A. Watkins, New York, N. Y. App. filed Oct. 17, 1923. Damping agent for the vibrating parts of an oscillograph for the purpose of eliminating distortion.

1,672,993. PROTECTIVE DEVICE; H. C. Snook, South Orange, N. J. App. filed Oct. 31, 1923. For the removal of excessive voltages from the circuits of electrical apparatus.

1,673,012. ELECTRICAL TOOL; L. F. Meunier, Cleveland, Ohio. App. filed May 5, 1925. Electric motor for portable or hand operated drills, grinders, etc.

1,673,020. RESISTANCE WELDING ELECTRODE; R. E. Powell, Maywood, Ill. App. filed May 22, 1925.

1,673,026. SEMI-MECHANICAL RECTIFIER; J. C. Schelleng, East Orange, N. J. App. filed July 28, 1922. Means for rectifying polyphase alternating current.

1,673,034. CONNECTER; W. J. Adams, Jr., Hartsdale, N. Y. App. filed Dec. 7, 1925. Means for making adjustable connections to electric circuit elements.

1,673,050. NOZZLE FOR ELECTRIC DRIERS; W. O. Lum, New York, N. Y. App. filed Dec. 2, 1924.

1,673,062. TRANSFORMER; D. W. Davis, Villa Park, Ill. App. filed Oct. 20, 1924. Adapted for use in connection with electrical appliances such as a night-lamp, annunciators, doorbells, toys and the like.

1,673,070. COMBINATION ELECTRIC PLUG AND SWITCH; S. N. Griffith, Monongahela, Pa. App. filed Oct. 18, 1923.

1,673,086. BATTERY-CHARGING CONNECTION FOR POTENTIAL CHARGING; G. E. Lundberg, Kewanee, Ill. App. filed April 8, 1927.

1,673,116. ELECTRICAL CIRCUIT; G. S. Jenkins, University City, Mo. App. filed Nov. 9, 1925. Demand limiting device.

1,673,135. WIRE CONNECTER; C. S. Beardsley, East Cleveland, Ohio. App. filed June 27, 1925.

1,673,140. HEATING APPLIANCE; M. Dechmann, Chicago, Ill. App. filed Jan. 22, 1927. Which may be used in the preparation of foods for invalids or infants, or for heating liquid.

1,673,198. PRIMARY CELL; M. L. Martus, Woodbury, and E. H. Becker, Waterbury, Conn. App. filed Oct. 5, 1926.

1,673,226. METHDO OF ELECTRIC HEATING; B. D. Bushell, Springs, S. E. T. Ewing, Johannesburg, and E. H. D. Brunner, Springs, Transvaal, South Africa. App. filed Aug. 7, 1926. For dressing tools such as rock drills in mining operations.

1,673,254. BALANCED ELECTRIC PROTECTIVE ARRANGEMENT FOR ALTERNATING-CURRENT SYSTEMS AND RELAYS THEREFOR; B. H. Leeson, Tynemouth, England. App. filed Sept. 20, 1924.

1,673,267. INCANDESCENT ELECTRIC LAMP; R. A. Price, Berwyn, Ill. App. filed May 15, 1924. Means for supporting the filament.

1,673,296. ELECTRIC HEATER, TOASTER AND COOKER; B. O. McManus, San Francisco, Calif. App. filed Dec. 27, 1926.

1,673,331. PROTECTIVE ARRANGEMENT FOR HIGH-TENSION ELECTRICAL APPARATUS; W. Hess, Basel, Switzerland. App. filed Jan. 11, 1924.

1,673,333. ELECTRIC COOKING, BAKING AND FRYING APPARATUS; G. Klumpp, New York, N. Y. App. filed March 21, 1927.

1,673,380. CLOCK-CONTROLLED ELECTRIC CIRCUIT; W. T. Trenwith, Evanston, Ill. App. filed Feb. 27, 1926.

1,673,385. ELECTRIC SWITCH; W. Wurdack, St. Louis, Mo. App. filed Nov. 2, 1925. Knife type.

1,673,395. GLUE POT; W. F. Clark, Warren, Pa. App. filed April 2, 1921.

1,673,400, 1,673,401, 1,673,402, 1,673,403. ELECTRIC BATTERY; H. M. R. Dam, Astoria, N. Y. Apps. filed Sept. 23 and Dec. 15, 1924, and May 1, 1925. Dry battery.

1,673,421. BATTERY; E. J. Petrie and G. R. Hannan, Los Angeles, Calif. App. filed March 10, 1926. Storage battery. Means for carrying the electrolyte of the battery in suspension and separating the plates.

1,673,422. PORTABLE TESTING SET FOR MEASURING LINE INDUCTION; C. T. Reisz, Chicago, Ill. App. filed May 22, 1926.

1,673,424. RAIL BOND; B. H. Ryder, Chicago, Ill. App. filed Sept. 22, 1921.

1,673,434. ELECTROLYTIC CONDENSER; E. F. Andrews, Chicago, Ill. App. filed Nov. 7, 1927.

1,673,463. BATTERY SEAL; W. A. MacKenzie, Los Angeles, Calif. App. filed March 23, 1927.

1,673,500. SPOT-WELDING MACHINE; E. F. Dwyer, Lynn, Mass. App. filed April 1, 1926.

1,673,518. SHORT-CIRCUITING DEVICE FOR MOTORS; G. H. Leland, Dayton, Ohio. App. filed April 26, 1924. For repulsion-induction motor.

1,673,543. ELECTRIC FURNACE; E. Wirz, Baden, Switzerland. App. filed May 14, 1927. Resistor furnace.

1,673,546. MOTOR-STARTING DEVICE; E. C. Balliman, St. Louis, Mo. App. filed Sept. 21, 1922.

1,673,553. CIRCUIT-INTERRUPTER RELAY; L. N. Crichton, Wilkinsburg, Pa. App. filed March 1, 1924.

1,673,567. ELECTRICALLY-HEATED TEMPERING BATH; L. P. Hynes, Albany, N. Y. App. filed Aug. 6, 1926.

1,673,582. INSULATOR STRUCTURE; W. K. Naylor, Pittsburgh, Pa. App. filed April 16, 1927. Pin-type.

1,673,587. STABILITY INDICATOR AND CONTROL SYSTEM; R. T. Pierce, Wilkinsburg, Pa. App. filed June 30, 1921. Means for indicating and controlling the relative stability of alternating-current generators and motors for electrically-propelled ships.

1,673,588. METERING SYSTEM; R. T. Pierce, East Pittsburgh, Pa. App. filed Aug. 14, 1924. System for transmitting meter indications to distant points.

1,673,591. TEMPERATURE INDICATOR AND CONTROLLER; T. A. Reid, Pittsburgh, Pa. App. filed April 13, 1922.

1,673,598. ALTERNATING-CURRENT SHUNT-COMMUTATOR GENERATORS; J. Slepian, Swissvale, Pa. App. filed Dec. 14, 1920.

1,673,610. FOOTLIGHT DEVICE; G. Weizsaeker, Paris, France. App. filed June 11, 1927.

1,673,635. SYSTEM OF DISTRIBUTION; J. C. Parker, Brooklyn, N. Y. App. filed July 22, 1925. For polyphase secondary networks.

1,673,654. APPARATUS AND METHOD OF GASEOUS REACTIONS; J. M. Weed, Scotia, N. Y. App. filed April 23, 1924.

1,673,667. PUSH-BUTTON SWITCH; F. C. De Reamer, Bridgeport, Conn. App. filed Oct. 7, 1924. For lamp sockets and similar devices.

1,673,673. ELECTRICAL CONVERTER; P. G. Girault, Paris, France. App. filed Dec. 14, 1922. To transform balanced polyphase currents to unbalanced polyphase currents or to a single-phase current, and vice versa.

1,673,676. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed Feb. 10, 1923. Of the oil break type.

1,673,677. ELECTRIC BATTERY COVER AND SEALING MEANS; W. E. Holland, Philadelphia, Pa. App. filed May 10, 1921.

1,673,681. TELEMETRIC SYSTEM; A. W. Hull, Schenectady, N. Y. App. filed Sept. 24, 1924. For transmitting the indications of an instrument or meter to a distant point over an electric circuit.

1,673,698. SYSTEM FOR RECTIFYING ALTERNATING CURRENTS; G. W. Muller, Charlottenburg, Germany. App. filed Aug. 22, 1927.

1,673,706. ARCING ATTACHMENT FOR ELECTRIC CONDUCTOR CLAMPS; B. A. Plimpton, Lima, N. Y. App. filed Oct. 5, 1920.

1,673,708. ELECTRIC IRON; L. Reichold, Winsted, Conn. App. filed Sept. 4, 1926.

1,673,712. ELECTRIC HEATER; A. H. Simmons, Oak Park, Ill. App. filed July 11, 1924. Table grill.

1,673,718. ELECTRIC REGULATOR; L. W. Thompson, Schenectady, N. Y. App. filed April 14, 1925. Vibratory type.

1,673,719. ANGULAR MAGNETIC CHUCK; H. E. Tracy, Worcester, Mass. App. filed Aug. 15, 1927.

1,673,738. ELECTRICAL CABLE CONNECTER; A. B. Dibner, Brooklyn, N. Y. App. filed June 17, 1925. Adapted especially for high electric currents.

Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

New Trade Literature

TRANSFORMERS. — Bulletin No. 628 issued by the Sorgel Electric Company, Milwaukee describes and illustrates its line of air-cooled, dry type, auto, insulating and special transformers in sizes ½ to 50 kva., single, two and three-phase.

SWITCHBOARD RECORDING INSTRUMENTS AND SWITCHBOARDS.—Bulletin GEA-585A issued by the General Electric Company, Schenectady, N. Y., covers its switchboard recording instruments, type C-18 and C-19 direct-current and types C-20 and C-21 alternating-current. The company also is distributing bulletin GEA-981 describing its factory-built complete industrial and small plant switchboards and gives the details of construction and the outlines and dimensions of the switchboards.

INDOOR CABLE TERMINALS. — Bulletin No. 711 issued by the Standard Underground Cable Company, Pittsburgh, Pa., division of the General Cable Corporation, covers its Standard indoor cable terminals and accessories. The bulletin contains illustrations and complete information, including drawings, dimension tables and other engineering information. Illustrations are given of a few special terminals designed to meet particular needs. A few installation views also are included.

DIESEL ENGINES. — The Busch-Sulzer Brothers Diesel Engine Company, St. Louis, has issued a catalog covering the two-cycle design, type E, Diesel engine, which is suited for direct or electric drive of vessels, for auxiliary use in motor and sailing ships and for stand-by and auxiliary service in land plants.

LIGHTING DATA.—The Edison Lamp Works of General Electric Company, Harrison, N. J., is distributing bulletin LD 109C, entitled "Lighting of Schools and Gymnasiums," and bulletin LD 144A, entitled "Street Lighting with Mazda Lamps." The bulletins contain many illustrations and very complete data on the subjects covered.

GROUNDING METHODS.—Bulletin No. 70 issued by the Borden Electric Company, 480 Broad Street, Newark, N. J., formerly the Groundulet Company, is a treatise on grounding methods for power house, substation and large industrial plant installations. The bulletin in addition combines all the available data on the subject. Power grounds, earth electrodes, grids and mats and other subjects are covered at length.

LOAD RATIO CONTROL EQUIPMENT. —Bulletin GEA-963 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its type LR-9 load ratio control equipment.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in The Hague, Netherlands (No. 31,967), of portable electric dishwashers.

An agency is desired in Stuttgart, Germany (No. 31,952), for hand and face electric driers and electrical medical appliances.

Purchase is desired in Recife, Brazil (No. 31,965), of electroplating apparatus.

Purchase is desired in Patras, Greece (No. 31,958), of generators and motors for paper factory.

An agency is desired in Berlin, Germany (No. 31,896), for household electrical appliances, another (No. 31,955) for electric refrigerators and electric washing machines and another (No. 31,954) for electric washing machines.

Purchase and agency are desired in Johannesburg, South Africa (No. 31,968), for X-ray apparatus.

Purchase or agency is desired in Ensenada, Mexico (No. 31,969), for individual lighting plants.

Any manufacturer desiring to establish agencies abroad may consult with the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce, where data on available agencies throughout the world are on file.

Directory of Electrical Associations

Printed in the First Issue of Each Volume

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, M. E. McIver, 63 East Adams St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Managing director, Lucius S. Storrs. General secretary, J. W. Welsh, 292 Madison Ave., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Colin G. Fink, Columbia University, New York City.

AMERICAN ENGINEERING COUNCIL. Executive secretary, L. W. Wallace, 26 Jackson Place, Washington, D. C.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, P. W. Henry, 111 Broadway, New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. National secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets bi-monthly. Sections and branches meet monthly in the principal electrical centers throughout the country. Three national and several regional conventions held each year.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS. Secretary, H. Foster Bain, 29 West 39th St., New York.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, M. M. Kelly, 29 West 39th St., New York.

ARIZONA UTILITIES ASSOCIATION. Executive secretary, Lee C. McMullough, 124 South Central Avenue, Phoenix, Ariz.

ARKANSAS UTILITIES ASSOCIATION. Secretary-treasurer, R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

ARTISTIC LIGHTING EQUIPMENT ASSOCIATION. Managing director, G. P. Rogers, 711 Graybar Bldg., 420 Lexington Ave., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

ASSOCIATION OF ELECTRAGISTS INTERNATIONAL (formerly National Association of Electrical Contractors and Dealers). Secretary, Laurence W. Davis, 15 West 37th St., New York City, N. Y. Direct membership throughout the United States and Canada.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Managing director, John F. Kelly, Empire Bldg., Pittsburgh, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Room 411, C. & N. W. Terminal Station, Chicago, Ill.

CANADIAN ELECTRICAL ASSOCIATION (affiliated with N.E.L.A.). Secretary, H. M. Lyster, 712 Power Bldg., Montreal.

COLORADO UTILITIES ASSOCIATION. Secretary-treasurer, O. A. Weller, Public Service Co. of Colorado, Denver, Colo.

EAST CENTRAL GEOGRAPHIC DIVISION, N.E.L.A. Secretary, D. L. Gaskill, Greenville, Ohio.

EASTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, R. Walker, fifth floor, 85 John St., New York City.

EASTERN GEOGRAPHIC DIVISION, N.E.L.A. Secretary-treasurer, Harold A. Buch, Telegraph Building, Harrisburg, Pa.

ELECTRIC ASSOCIATION (THE) (Chicago). Manager, R. Bourke Corcoran, 30 North Dearborn St., Chicago, Ill.

ELECTRICAL LEAGUE OF COLORADO. Executive manager, George Bakewell, Jr., Gas & Electric Bldg., Denver, Colo.

ELECTRICAL LEAGUE OF UTAH. Executive secretary, R. E. Folland, Newhouse Hotel, Salt Lake City, Utah.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Walter F. Field, Safety Cable Co., Division of General Cable Corporation, New York City.

ELECTRICAL WHOLESALERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

GEORGIA ELECTRICAL ASSOCIATION. Secretary-treasurer, J. J. McDonough, Georgia Power Co., Brunswick, Ga.

GREAT LAKES GEOGRAPHIC DIVISION, N.E.L.A. Secretary-treasurer, R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, L. H. Graves, 29 West 39th St., New York City.

ILLUMINATING GLASSWARE GUILD. Assistant business manager, C. H. Ferris, Stevenson Corp., 19 West 44th St., New York City.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, William Stokes, 1548 Consolidated Building, Indianapolis, Ind.

INSTITUTE OF RADIO ENGINEERS. Secretary, John M. Clayton,, 33 West 39th St., New York City.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, H. N. Lang, P.O. box 1864, Orlando, Fla.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body formed of 26 national electrotechnical committees). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N.E.L.A. Secretary and treasurer, H. E. Weeks, Davenport, Iowa.

KANSAS SECTION, N.E.L.A. Secretary, H. Lee Jones, 401 National Reserve Building, Topeka, Kan.

KENTUCKY ASSOCIATION OF PUBLIC UTILITIES. Secretary, E. F. Kelley, Louisville Railway Company, Louisville, Ky.

MARYLAND UTILITIES ASSOCIATION. Secretary, D. E. Kinnear, United Railways & Electric Co. of Baltimore, 1005 Continental Bldg., Baltimore, Md.

MICHIGAN ELECTRIC LIGHT ASSOCIATION. Secretary, Herbert Silvester, 401 South Main St., Ann Arbor, Mich.

MIDDLE WEST GEOGRAPHIC DIVISION, N.E.L.A. Secretary-treasurer, T. A. Browne, 1519 O St., Lincoln, Neb.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS. Secretary, James B. Walker, 270 Madison Ave., New York.

NATIONAL COMMITTEE ON THE RELATION OF ELECTRICITY TO AGRICULTURE. Director, E. A. White, 1120 Garland Bldg., Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Managing director, Paul S. Clapp, 420 Lexington Avenue, New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1008 Marquette Building, Chicago, Ill. Central, New England, New York, Middle and Southern Atlantic States and Pacific Coast Divisions.

NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION. (Consolidation of Associated Manufacturers of Electrical Supplies, Electric Power Club and Electrical Manufacturers' Council.) Managing director, Alfred E. Waller, 420 Lexington Ave., New York City.

NATIONAL ELECTRICAL WHOLESALERS' ASSOCIATION. Managing director, E. Donald Tolles, 165 Broadway, New York City.

NATIONAL FIRE PROTECTION ASSOCIATION. Chairman of electrical committee, A. R. Small, 109 Leonard St., New York City.

NATIONAL SAFETY COUNCIL. Managing director and secretary, W. H. Cameron, 108 East Ohio St., Chicago, Ill.

NEBRASKA SECTION, N.E.L.A. Secretary-treasurer. T. A. Browne, 1527 Sharp Building, Lincoln, Neb.

NEW ENGLAND GEOGRAPHIC DIVISION, N.E.L.A. Secretary, Miss O. A. Bursiel, Statler Building, 20 Providence St., Boston, Mass.

NEW JERSEY ELECTRIC ASSOCIATION. Secretary-treasurer, S. F. Delany, 1600 Pacific Ave., Atlantic City, N. J.

NEW MEXICO UTILITIES ASSOCIATION. Secretary-treasurer, Bernard L. Wiles, Albuquerque, N. M.

NEW YORK ELECTRICAL LEAGUE. Secretary, David T. Brown, 270 Canal St., New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, H. E. Farrer, 29 West 39th St., New York City.

NORTH CENTRAL ELECTRIC ASSOCIATION (Geographic Division N.E.L.A.). Secretary-manager, J. W. Lapham, 803 Plymouth Bldg., Minneapolis, Minn.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION (Geographic Division N.E.L.A.). Secretary, Berkeley Snow, 1206 Spalding Building, Portland, Ore.

OKLAHOMA UTILITIES ASSOCIATION. Manager, E. F. McKay, 1020 Petroleum Building, Oklahoma City, Okla.

PACIFIC COAST ELECTRICAL ASSOCIATION (Pacific Division N.E.L.A.). Secretary, Samuel H. Taylor, Suite 729-730, 447 Sutter St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N.E.L.A.). Managing director, A. B. Millar; secretary-treasurer, Harold A. Buch, Telegraph Bldg., Harrisburg, Pa.

PUBLIC UTILITIES ASSOCIATION OF VIRGINIA. Secretary, A. B. Tunis, 406 Grace Securities Bldg., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, A. Bliss McCrum, P.O. box 1483, Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, J. L. Bernard, 55 West 42d St., New York City.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N.E.L.A. Secretary, O. A. Weller, Public Service Co. of Colorado, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. President, W. W. Freeman; chairman executive committee, C. L. Edgar; secretary-treasurer, J. Smieton, Jr., 420 Lexington Ave., New York. Annual meeting second Friday in September; directors' meetings second Friday in March, June, September and December; executive committee meetings every thirty days.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOCIETY OF INDUSTRIAL ENGINEERS. Secretary, Geo. C. Dent, 205 W. Wacker Drive, Chicago, Ill.

SOUTHEASTERN GEOGRAPHIC DIVISION, N.E.L.A. Secretary, C. M. Kilian, 207 Bona Allen Bldg., Atlanta, Ga.

SOUTHEASTERN WATER AND LIGHT ASSOCIATION. Secretary-treasurer, F. W. Chapman, Camden, S. C.

SOUTHWESTERN GEOGRAPHIC DIVISION, N.E.L.A. Secretary, S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

SOUTHWESTERN PUBLIC SERVICE ASSOCIATION. Secretary, E. N. Willis, 403-4 Slaughter Bldg., Dallas, Tex.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, L. E. Merrow, Montpelier, Vt.

WESTERN SECTION, INTERNATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS (successor to Western Association of Electrical Inspectors). Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS. Secretary, E. S. Nethercut, 205 West Wacker Drive, Chicago, Ill.

WISCONSIN STATE ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Chairman and secretary, L. W. Burch, 202 East Washington Ave., Madison, Wis.

WISCONSIN UTILITIES ASSOCIATION. Executive secretary, John N. Cadby, 432 Broadway, Milwaukee, Wis.

WYOMING UTILITIES ASSOCIATION. Secretary, L. J. Meyer, Mountain States Telephone & Telegraph Co., Cheyenne, Wyo.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Wholesale Prices and the Charge for Energy

THE electric light and power industry is intimately bound up with the progress of all other industries. To some it supplies an essential raw material, energy. On some it in turn depends for materials used in its own growth—building materials, metals and metal products, fuel. Moreover, since no country stands alone in this day of international commerce, statistics relating to foreign countries are also of significance to it.

A chart of wholesale commodity prices using the 1913 level as a basis and derived from data compiled by the United States Bureau of Labor Statistics has recently been published by the National Industrial Conference Board and is here reproduced together with another, also based on authoritative information, contrasting American and European price levels.

From these evidences of past movements the trend for the future may be surmised. In the former the post-war peak need scarcely to have attention called to it. For subsequent years the secondary jump in the price of fuel in 1922 stands out conspicuously. On the other items the fluctuations since the middle of 1922 have been comparatively mild. The weighted average of them all has not departed wisely from a price level about 50 per cent above that of 1913.

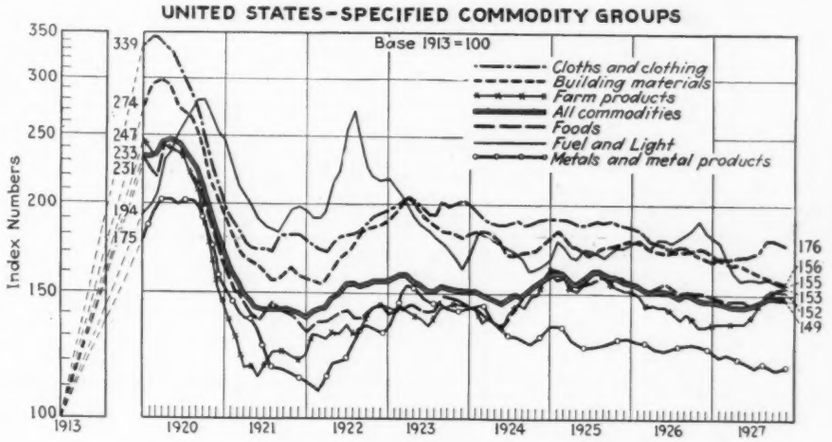
Since the slump of 1921 the only commodity which has had a definite, if fluctuating, upward trend is agricultural products. In connection with the construction of new plants interest attaches to the present downward trend of building materials, of metals and of fuel and light. Metals and metal products were, at the end of 1927, only 19 per cent above the 1913 level, and the trend has been continuously downward since the early part of 1923. The item of cloths and clothing is relatively the highest, its index number being 176.

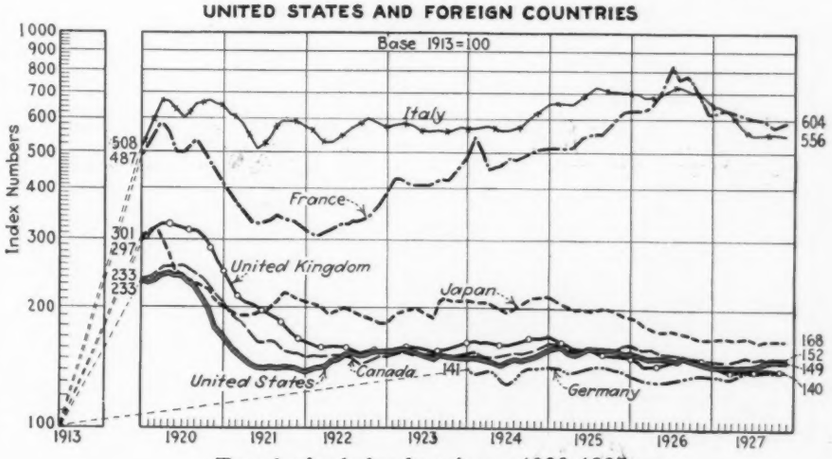
A corresponding index of wholesale prices for electrical energy running back through 1913 is not available, but from the same source as that used for the upper chart, the Bulletin of the Bureau of Labor Statistics, there is available a retail price index. It is a composite of retail prices of electricity in a considerable number of cities in various parts of the country. The chart plotted from those statistics shows a continuous downward trend. While all other items on the charts showed a striking increase, the retail price of electrical energy has consistently been below that of 1913, even during the years immediately following the war, when other prices reached their peak. At the end of 1927 it was 12.4 per cent lower than in 1913.

In most foreign countries the period following the war has brought a striking increase. That is particularly noticeable where the monetary unit has not been stabilized at a value corresponding to its former buying power. It happens that the three English-speaking countries shown on the chart were able either to hold to their standards or to re-establish them at their original value within a short time. Their index numbers are close together.

Germany made a fresh start in 1924 and for some years her index number has been the lowest among the great nations. The highest, at present, are France and Italy, both having a depreciated currency, with index at 604 and 556 respectively.

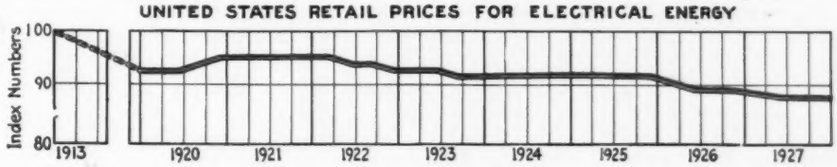
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.





Trend of wholesale prices—1920-1927

(By courtesy of National Industrial Conference Board, Inc., New York City)



Western Operations Under Last Year

THAT the manufacturing plants of the Western States witnessed a materially decreased rate of productivity during May, and were also operating materially under the rate reported for May last year, is indicated by reports received on monthly electrical energy consumption by some 400 large manufacturing plants operating in this section. May rate of operations were almost 4.3 per cent under April and about 11 per cent under May of last year, after corrections are made for the number of working days in the various months. A decreased rate of production was also witnessed during the first five months of the current year, the average rate of operations for the period being 2 per cent under that witnessed during 1927. The present indications are that the record rate of operations recorded by the manufacturing plants of the Western States during the summer months of 1927 will not be equaled during the current summer. The expected seasonal increase in the operations of the food manufacturing plants, however, may be such as to raise the index of operations during the coming months to a point very close to that of last year.

Indexes of Productive Activity in the Western States

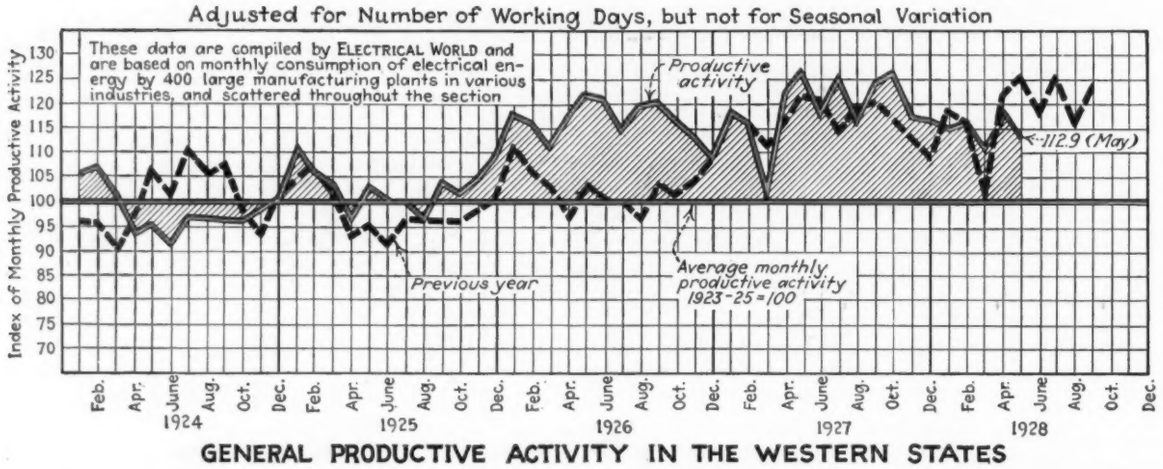
All Figures Adjusted for Number of Working Days

	May, 1928	April, 1928	May, 1927	Average for First Five Months, 1928	Average for First Five Months, 1927
All industry	112.9	117.8	126.8	114.5	116.7
Chemicals and allied products	90.0	108.7	118.4	97.8	114.9
Food and kindred products	97.4	103.0	113.2	101.6	105.2
Lumber and its products	128.2	127.6	115.8	125.7	110.8
Metal industries group	124.0	123.3	161.0	123.6	151.0
Paper and pulp	150.0	150.3	137.6	144.6	133.7
Rubber	133.7	140.8	123.3	141.1	.....
Shipbuilding	94.2	104.6	134.0	95.3	128.4
Stone, clay and glass	154.5	155.2	150.5	154.2	.....

The decreased rate of operations recorded by general industry was not recorded, however, by all the primary groups. Four important groups—lumber and its products, paper and pulp, rubber and its products and the stone, clay and glass groups—all reported increased operations over May last year, the lumber industry recording an increase of 10.7 per cent. Four important groups, however, reported operations under May, 1927.

ELECTRICAL WORLD *Barometer of Industrial Activity in the Western States*

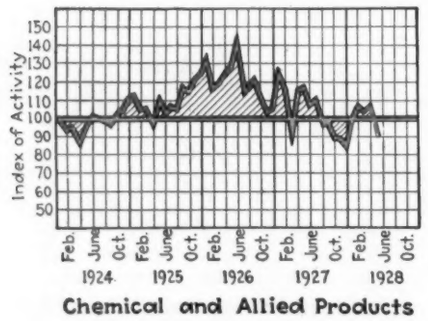
Adjusted for Number of Working Days, but not for Seasonal Variation


These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Index of Monthly Productive Activity
Productive activity
112.9 (May)
Previous year
Average monthly productive activity 1923-25=100
1924
1925
1926
1927
1928

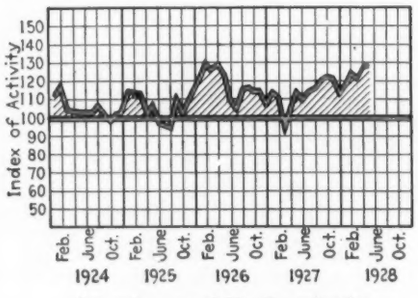
States in WESTERN *Group*

Arizona
California
Colorado
Idaho
Montana
Nevada
New Mexico
Oregon
Utah
Washington
Wyoming

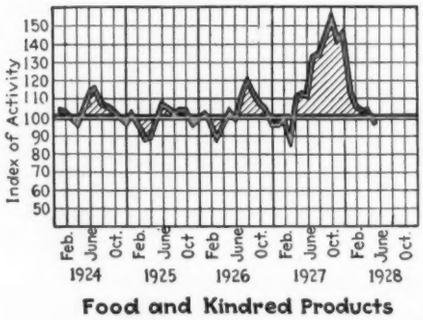
GENERAL PRODUCTIVE ACTIVITY IN THE WESTERN STATES



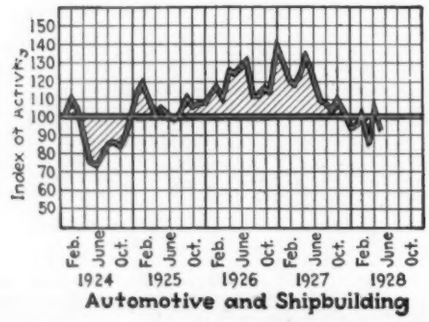
Chemical and Allied Products



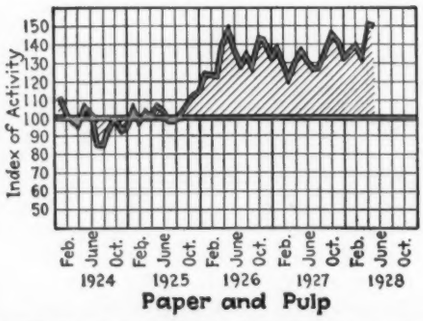
Lumber and Its Products



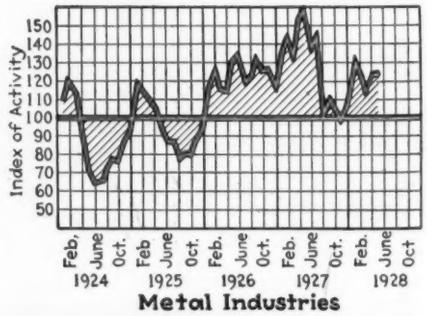
Food and Kindred Products



Automotive and Shipbuilding



Paper and Pulp



Metal Industries

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE WESTERN STATES